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LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C.4. SUBSCRIPTION per annum, Postage, inclusive in Great Britain, £1 1s. 8d. Canada, £1 2s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
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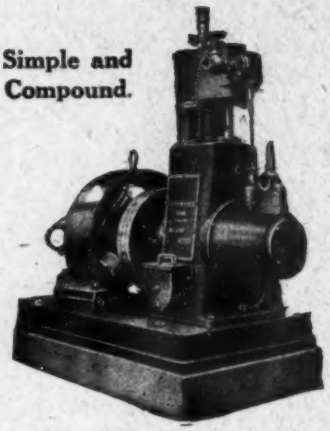

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ELECTRICAL REVIEW.

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INSTITUTION PROCEEDINGS.

THE busy season for the engineering institutions is now opening, and promises to be a very busy one indeed. We have frequently suggested that the conduct of their meetings might be improved in two ways, and we note with pleasure that *The Times Engineering Supplement* for October sees eye to eye with us in respect of one of them—that is, the reading of papers. Precisely the same arguments that we have used are advanced—namely, that in accordance with "the same old ritual," most of the time is devoted to the reading of the paper, "often with an elocution that leaves a good deal to be desired," and that the objects of the institution would be far better served by taking the paper as read, and devoting the whole time to the discussion. This involves the distribution of the paper in advance to those who are in a position to attend the meeting—that is, to those who live within range of the rendezvous; members who would travel long distances—as many do—to attend a discussion would be sure to obtain a copy of the paper in advance. At present the time of the meeting is sacrificed to the lethargy of those members who will not take the trouble to acquaint themselves beforehand with the contents of papers, though some apologise for their remissness and then have the hardihood to take part in the discussion!

During the war we did not press the point, having in view the scarcity of paper; now, no doubt, the excessive cost of printing may be alleged as a reason for continuing the "same old ritual." But the claims of efficiency over-ride any such objection. The efficiency of the Institution of Electrical Engineers, for example, has greatly increased during the last few years—and *so has its membership*. Money spent on increasing efficiency and prestige is far more than repaid by additional subscriptions.

The second point is the hour of meeting, to which our contemporary does not refer. During the war the meetings have generally commenced at 6 or 6.30, for reasons which no longer obtain. But why change the hour? To suit whose convenience? The wishes of the majority should prevail in any democratic institution, and it is the duty of those who are elected to control its affairs to find out a way of ascertaining the views of the majority of the members in a position to attend the meetings.

These are two questions of considerable importance. We would invite the Council of the Institution of Electrical Engineers in particular to give them careful consideration. We believe that Institution has now become, out of question, the most efficient of the great British engineering institutions (not that the competition it has to meet is very severe), and its influence has rapidly and markedly increased, both within and without the electrical industry, under the shrewd guidance and forceful propulsion of Mr. Wordingham; and we look to it not only to do the best for its own members, but also to give a lead to the kindred associations.

New Cable Standards.

The recent revision of the standards for electric lighting and power cables by the British Engineering Standards Association has now come into force, and we have received a number of catalogues from leading cable makers which embody the new standards. The revision marks a complete departure from the long-established system based upon the standard wire gauge; the cross-sectional areas of the cables—the really significant dimensions—have been adopted as the ruling factors, with the result that 24 sizes take the place of 59. This is an excellent and timely reform, which will greatly simplify both manufacture and use, without introducing any disadvantages; we understand that the change was made at the express wish of users of cable, while the hearty concurrence of the makers can be taken for granted. At the same time, a valuable reform has been introduced, on lines which we have advocated for many years—namely, in the direction of "counting in tens"; in future details and prices will be stated in terms of 1,000 yards instead of 1 mile, and standard coils will be 100 yards long instead of 110, the sixteenth of a mile. This will not only dispense with a great deal of useless and utterly superfluous computation, but also will facilitate the adoption of the metric system at a later date. Incidentally, we note that the new B.E.S. specification for permanent-magnet steel uses millimetres throughout.

The British Engineering Standards Association, the Cable Makers' Association (which in 1900 led the way with a standard table), and the industry in general are to be congratulated on the achievement of a notable advance in standardisation, from which great benefits will accrue.

State or Private Control?

Wherever there is water power to be developed, the extent to which Government assistance should be given, and Government control exercised, is a problem of primary interest. So far as India is concerned, a policy suitable for one part of the country may be quite unsuitable elsewhere. Thus, at Bombay, the chain of projects extending down the Western Ghats covers all likely power requirements for a long time to come, and the firm of Messrs. Tata can supply the capital, the business organisation and the engineering talent required; Government help is necessary, however, in such matters as land acquisition, water rights, transmission routes, &c. Elsewhere, it is generally considered that more direct Government assistance is required either in the form of pioneer installations (built for demonstration purposes, and subsequently handed over to private companies), and/or in the form of guarantees to private enterprise. In the latter case a guarantee of a minimum interest on the one hand should generally be coupled with a share in excess profits over a moderate return on the other hand. Government operation of an established power scheme is deprecated because (amongst other reasons) the Government is apt to be unwilling to scrap obsolete plant; this criticism, says Mr. Meares in his Report on the Water-Power Resources of India, applies to a considerable extent to British firms especially as compared with American practice.

Government assistance in preliminary investigation, and even in the detailed survey of sites, will be welcomed universally, and as regards roads, railways, and other communications, the public naturally looks to the Government for help; without it, the cost of a long mountain road may wreck a promising scheme.

The question of charges for water power is by no means a simple one. In general, it is sound policy for the State (assuming that it has the control of water rights) to charge a nominal amount for the use of the water for power purposes, and depend for its main revenue on profit sharing with the power company. Water utilised for power purposes cannot be sold on the same basis as water consumed for irrigation purposes, except, perhaps, in the special case in which a costly reservoir is essential to the project. Cheap power is of greater benefit to the community than any practicable increase in revenue derived from high water rates. In the words of the late Mr. Barlow, "The interests of the State are better served by the development due to greater use of water, than by the collection of small sums annually for the use of water."

In a review of the general conditions under which concessions for water power should be granted, Mr. Meares points out that it is necessary to guard against:—(1) Failure of the concessionaire to develop the site fully and in a satisfactory manner within reasonable time; (2) injury to existing water rights and future irrigation demands; (3) failure of the concessionaire to continue using the water power fairly and adequately; (4) hindering of future developments (interlinking, &c., of networks) by failure to adopt British engineering standards of pressure and frequency.

Improperly Supplying Electricity to a Neighbour.

A correspondent has drawn our attention to a case in which a supply company has reason to believe that electricity is being obtained from it under peculiar circumstances. It appears that a man who lives next door to a consumer is obtaining electricity from his neighbour, whose installation has been tapped. The energy used passes through the consumer's meter, and is, therefore, paid for, but the consumer is only paid an agreed sum. The question here arises—has any breach of contract or offence been committed, and, if so, what is the remedy, if any, of the company? Sec. 23 of the Electric Lighting Act, 1882, provides that "Any person who maliciously or fraudulently abstracts, causes to be wasted or diverted, consumes, or uses any electricity shall be guilty of simple larceny and punishable accordingly." It is extremely doubtful whether the facts above stated would amount to larceny within the meaning of this section; but Sec. 18 of the Gasworks Clauses Act, 1847, which is incorporated with the Electric Lighting (Clauses) Act, 1899, seems to cover the point. That section makes it an offence to "supply any other person with any part of the *electricity*" supplied to him by the undertakers. The penalty is £5 for each offence and 40s. for every day the communicating wire remains *in situ*. In addition to this the company may cut off the supply.

Switzerland—for the Swiss.

The collapse of the mark currency, and the inundation of Switzerland with German goods, have produced serious apprehensions in industrial circles in Switzerland, and a conference has just been held at the National Economic Department at Berne of representatives of industry, trade, and consumers, in order to discuss measures for the prevention of the economic invasion of the country, particularly by the manufacturers in the countries of the Central Powers. Among the branches represented were the electrical industry, the mechanical engineering trade, and the motor-car, paper, and furniture branches. It appears that numerous complaints have been made that neighbouring countries, taking advantage of the rate of exchange, have thrown a quantity of goods on the Swiss market at prices at which it is quite impossible for the native firms to compete, and hundreds of applications have been made to the Federal Council in favour of the issue of import vetoes or the placing of surtaxes on the existing Customs duties. As the demands put forth in this direction by different industries are incompatible with the urgent demand of the general community for lower prices, and the introduction of

an embargo on imports would not be without effect upon the general commercial relations with other countries, the question arises what action the country should take in the matter.

Herr Stucki, chairman of the Expert Commission appointed by the Federal Council last February to examine the question of import vetoes, threw cold water on the suggestions for their introduction. He stated that the Commission by a majority resolved to recommend the Federal Council to abstain from adopting any measures in regard to the import policy, only a few branches which are in a necessitous condition requiring protection. As Switzerland is an export country, and herself is insisting upon the abolition of foreign import vetoes, the Commission considers that it is impossible for Switzerland to introduce such measures. Germany has already raised the transit vetoes; the Swiss export trade to the East has been organised, and England, France, and Italy, with few exceptions, have discontinued the import embargoes, whilst Germany only maintains the prohibition on Swiss articles of luxury. But as all countries have an interest in the appreciation of the mark the Commission holds that German imports cannot be stopped, as otherwise the latter country would resort to reprisals, and surtaxes would also be confronted by almost unsurmountable difficulties. The Commission further disputes the assertion that the situation in Switzerland is solely due to the low level of the mark currency, and then gives expression to the expectation that equalisation in the international markets will soon take place as a result of the increase in the cost of production which is proceeding in Germany through the high prices of imports into that country.

The conference was presided over by Herr Schulthess, member of the Federal Council, who promised, in bringing the discussion to a close, that the wishes of industrial circles should again be considered by the Commission. At the same time, he remarked that Switzerland had to handle the problem of imports from the standpoint of international relations, and could make no exceptions which would lead to a rupture of commercial-political relations with the Central Powers.

Industrial Psychology and Scientific Management.

A great deal has been heard of late of industrial psychology and scientific management as aids to increased output. Scientific management, of course, is by no means new in this connection, even in this country, although there is some evidence that the true principles of scientific management, as laid down by Taylor and Gilbreth in America, are in danger of being misinterpreted in this country. Scientific management is a comprehensive term, and in its true interpretation is obviously intended to be applied throughout a works. Many students of it in this country appreciate it in that manner, but others are too prone to give it its narrower meaning of "studying the job." It is that aspect of it which has been prominent during the war, and the peculiar conditions of the work in munition factories have lent themselves to that somewhat false conception. Several examples have been quoted of wonderful results of increased production by what may be termed stop-watch methods, but a consideration of the circumstances usually shows that special conditions exist which it would not be easy to reproduce in ordinary commercial practice. There is, for instance, the recent case of the foundry at Derby, where, by means of the application of motion study principles, and a specially-designed system of payment by results, a considerable increase in output was undoubtedly obtained. That instance, however, is typical of many similar ones, information concerning which was brought to light during the war.

The work was of a simple repetitive nature for which the Government provided orders for a continuous and unlimited output. If these conditions could be reproduced under commercial conditions, similar results could be obtained. The application of real scientific management, with a view to speeding-up output throughout the various departments of a large works, involves far more than "studying the job" in the manner indicated, and it is when the more comprehensive view of scientific management is taken that the value of the study of industrial psychology comes into play. The latter is more or less a new science in this country, but that it is making rapid headway is seen in the establishment of an Industrial Section of the British Psychological Society, many members of which are large employers of labour. Dr. C. S. Myers, of Cambridge, is the leading exponent of industrial psychology at the present time in this country, but it is being studied all over the country in connection with the psychological laboratories which have been established at the leading universities outside Cambridge and Oxford. Scientific management is bound up with the study of industrial psychology, motion study, industrial fatigue, and so on, and can only give the best results when applied in relation to the special peculiarities of every business. No hard-and-fast rules can be laid down, but there is little doubt that from a closer study of industrial psychology will spring means for improving output which can be applied to commercial industrial conditions, as apart from the specially advantageous conditions which have enabled so many remarkable results to be recorded in connection with war work.

The first essential to success is to bring labour into a somewhat different attitude of mind from that prevailing at the moment. In all the experiments to which prominence has been given it is laid down that the goodwill of the workpeople is the desideratum, and when that is achieved as a general rule we shall undoubtedly see a vast improvement in output, even without what may be regarded by some as the adventitious aids provided by the doctrines of Taylor and others who have followed him. When we can get the workpeople discussing means of increasing output, the real chance for the extended application of the principles of scientific management on the lines indicated will have come.

Germans to Buy Through Holland.

It is announced from Rotterdam that "all the works" belonging to the "Siemens works" have decided to establish at Rotterdam a central bureau for the purchase of the raw materials required by them. The announcement might lead innocent people erroneously to assume—as it would be erroneous—that the Germans have not been working in Holland, and through Holland, in order to get raw materials and maintain trade connections throughout the war. But the blockade placed an effective damper on these efforts either from German or Dutch pro-German sources.

The Way to Get Business.

As is tolerably well known, the big manufacturing firms in Germany have for many years past followed the practice of taking up a financial interest in many electricity supply companies, even when they themselves have not been the actual promoters, for the purpose of ensuring initial business and repeat orders, if not orders in perpetuity. In this way the firms have assured themselves of a large amount of work and profits as regular transactions. The same idea has now occurred to a smaller undertaking, although in a reverse direction. This is the Dr. Paul Meyer Co., of Berlin, makers of apparatus and instruments, who have just decided to increase the ordinary share capital by £125,000 to £300,000. Some surprise was recently manifested among the shareholders of this company when the directors announced that the whole of the new issue of capital was intended to be allotted, not to the shareholders, but to the Electric Light and Power Installations Co. of Berlin and the Electrical Installations Co. of Berlin, both of which exercise control over a number of supply works in different parts of the country. These two companies have already placed large orders with the Meyer Co., and others are in prospect, so that the shareholders are now satisfied with the apportionment of the new shares for £125,000 in equal parts to the two installation companies, the price of issue being at par value.

ROGER T. SMITH,

President of the Institution of Electrical Engineers.

The office of President of the Institution of Electrical Engineers is the highest distinction in the power of the electrical engineering industry to bestow; it has been filled successively by the most brilliant and able men of their time, not one of whom has failed to confer upon it added lustre, and in congratulating Mr. Roger Smith on his attainment of that enviable honour, we venture to express the utmost confidence that in his hands it will lose nothing of its dignity or prestige, and that the interests of the Institution and of the industry, which are, in fact, identical, will be zealously fostered and safeguarded.

Mr. Smith, who is a member of each of the great engineering Institutions—Civil, Mechanical, and Electrical—and has for six years been a member of Council of the last named, has had a wide and varied experience which admirably fits him for the duties of the post which he now occupies. Commencing his scientific training in 1880 at University College, London, where he obtained the General Certificate in Mechanical Engineering, he won the Clothworkers' Company's Exhibition in Physics, and took the degree of Bachelor of Science; he returned to his *alma mater* in 1893 for a course in electrical engineering and laboratory work, in which he was a prizeman. In the interval he had spent four years' pupilage in mechanical engineering at the works of Messrs. Hathorn, Davey and Co., Leeds, and as charge hand had supervised the erection of pumping machinery for five waterworks or sewage works, besides acting for three years as the representative of Messrs. Easton, Anderson and Goolden, Ltd., in India, where he erected, tested, and maintained pumping machinery for the waterworks of five large cities, three of which works he designed himself; he was for six months municipal and water engineer at Allahabad.

Elliott & Fry.] ROGER T. SMITH. *[London.*

Returning, as above stated, to college for a year, for special electrical training, Mr. Smith, in 1894, became a resident engineer under Sir Alex. Kennedy at the Davies Street station of the Westminster Electric Supply Corporation, but in 1895 he went abroad again, as technical manager for the Imperial Continental Gas Association of La Cie. Hydro-Electrique Anversoise, supplying Antwerp with hydraulic and electric power. In 1898 he joined Sir Alex. Kennedy's staff as assistant, and made surveys and preliminary designs for five British electricity supply schemes, one electric railway, and one tramway, and was in charge of the L.C.C. electric tramway scheme in its earlier stages. He went to Buenos Aires as representative for the electric tramway scheme of that city, and on returning to England he was in charge of the electric railway, power, and lighting scheme for the Great Western Railway. In 1905, on the completion of the above scheme, Mr. Smith joined the G.W.R. as their electrical engineer, taking charge of the supply of electricity for traction, power, and lighting in the London district. He designed and carried out the generating stations, distribution, and electrical machinery and lighting for two harbours; the electrical equipment of 16 goods stations and docks; the electrical machinery for three Scherzer bridges, and for 10 passenger stations and yards, and the electric lighting of 20 passenger stations, and 77 offices, hotels, &c. The plant under his control comprises electrical machinery of 27,000 H.P., 1,400 arc lamps, 25,000 glow lamps, and the electrical equipment of some 800 coaches. Mr. Smith also designed, specified, and is now carrying out the sub-station machinery, electrical distribution and equipment for the Ealing and Shepherd's Bush electric railway connecting the Central London Railway with Ealing.

In promoting the interests of the electrical industry, Mr. Smith has for many years taken a prominent part; in 1911 he read a paper on "Electric Train Lighting," before the Institution of Civil Engineers, for which he was awarded the George Stephenson Gold Medal. As a representative of the Institution of Electrical Engineers on the General Board and on the Executive Committee of the National Physical Laboratory, and on the Electrical Sectional Committee of the British Engineering Standards Association, and as a member of several of the Sub-Committees and Panels of the latter, he has spent much time and labour in the service of the public. He was a delegate for the International Electrotechnical Commission at Paris this year, and a delegate and member of Council at the Commission, at its meeting in London last week. He also represented the Railway Executive Committee as a witness before the Board of Trade Electric Power Supply Committee in 1917. During 1918 and 1919 he has represented the Railway Executive Committee on arbitrations before the Committee on Production or the Interim Court of Arbitration on Labour matters affecting the electrical workers on British railways, and in negotiations and arbitrations affecting the electrical staffs or employés of British railways with various Trade Unions; and he is a technical adviser to the Committee of the Railway Companies' Association dealing with the Electricity Supply Bill, 1919.

Mr. Smith has constantly displayed keen interest in the

proceedings of the Institution of which he is now the head, frequently joining in the discussions; his modest and unassuming disposition, his sincerity and earnestness, and his geniality of temperament, have gained for him a measure of esteem and popularity which ensures that during his term of office he will possess the confidence of the members of the Institution, and can command their loyal support. It is particularly appropriate that, at a time when the subject of the electrification of railways is prominently before the public and the engineering profession, an engineer whose career has been largely identified with railway work should be President of the Institution of Electrical Engineers; but the wide range of experience which Mr. Roger Smith has acquired in all branches of the electrical industry ensures that he will do full justice to all the varied interests which are represented by that Institution. Mr. Smith takes the chair in succession to the most energetic, broad-minded, and progressive President within our recollection; in common with our fellow members, we confidently look to him to carry on the work which has been so ably begun, and to aim at the ideal of establishing the influence and prestige of the Institution of Electrical Engineers on the firmest basis as *primus inter pares*, whilst sparing no effort to make the Institution as serviceable as possible to its members.

THE WATER-POWER RESOURCES OF INDIA.

(*Concluded from page* 490).

Fuel *v.* Water-power.

Granted that a water power project holds the possibility of power development adequate in quantity and continuity, it yet remains to compare it with a fuel burning power station in order to determine its commercial possibilities. The water power station is almost invariably more costly to construct, and all that it saves is the cost of fuel. Subject to minor qualifications in individual cases, the criterion of success is whether the capital charges for interest and depreciation on the *excess* cost of the water power undertaking will be substantially less than the alternative cost of fuel.

The solution of this problem is simple in individual cases, but it must take into account local costs, and must also compare the cost of electric power transmission with the cost of carrying raw materials to, and finished products from, the source of power. Finally, the load factor is of great importance, particularly where the standing charges are high. An example in the report shows how the admissible cost of hydraulic development may be estimated in any particular case. Water power can rarely compete if coal costs less than Rs. 10 per ton; but will invariably prove cheaper for a well-sustained industrial load if coal costs over Rs. 30 per ton. Between these limits, proper estimating is required.

Power Used in India.

It was found in 1917 that the electric power used in various industries and localities in India amounted roughly to 215,000 kw., of which 36 per cent. was obtained from water power, the total units generated amounting to 550 millions. The following comparison with other parts of the Empire shows how backward is the electrical development of India:—

	Watts installed per capita.	Sq. miles per kw. installed.
Canada	148 ...	3·5
Australasia ...	62 ...	11*
South Africa ...	57 ...	1.4
British Isles ...	33 ...	0.083
India	Under 1	7.6

* Largely uninhabited.

No complete census of the total power requirements of India has yet been undertaken, but suggestions for such a census are made in this report. Approximate data are, however, available from returns by Directors of Industries and Controllers of Munitions. From these, it appears that the power of all kinds used in the stated parts of India exceeds 1,153,000 B.H.P., made up as follows:—

	B.H.P.	
Assam	22,550	
Bengal	25,318	
Calcutta area	176,200	(jute, 85,000; cotton, 75,000).
Bihar	2,325	(excluding collieries, &c.)
Bombay Presidency	32,872	
Bombay City area	750,000	(principally cotton mills).
Burma	17,750	(excluding rice mills, &c.)
Central Provinces	32,773	
Madras...	39,568	(rice mills, irrigation and ginning).
North-West Frontier Province	—	
Punjab...	15,734	(steam only).
United Provinces	38,548	
	1,153,638	

For a full discussion of the new industries which may grow up in India if cheap electric power is available, reference should be made to the Report of the Indian Industrial Commission, and to the Industrial Handbook, 1919, issued by the Indian Munitions Board.

Amongst these industries may be mentioned the electric smelting of indigenous iron ores and the electrical production of steel and its alloys; electric welding (now extensively employed); the manufacture of aluminium from alumina prepared from local bauxite deposits; the manufacture of calcium carbide and its derivatives; the fixation of atmospheric nitrogen; the electrolytic production of chlorine; and the preparation of phosphorus and abrasives. In all these industries cheap power and large scale production are essential to success.

Probable Water-power of India already Determined. Continuous Electrical Horse-power.

Province.	Developed and under construction.	Known sites.	Probable sites.	Total.	Sites unexamined.	Remarks.
Assam	nil.	33,200+	18,000	51,200	10	—
Bengal	600	50,600 +	153,000	203,600	2	Tista has also vast power.
Bihar and Orissa	nil.	10,000	2,800	12,800	9	—
Bombay	85,000	189,800	68,500	343,300	9	—
Burma	14,460	10,000	429,000	455,000	over 40	Great rivers in north not examined.
Central Provinces	nil.	20,000?	133,000	153,000	24	—
Cochin	—	25,000	—	25,000	—	—
Kashmir	28,300	30,000	—	58,300	—	Himalayan rivers have great unexplored power.
Madras	1,350	94,000	12,000	107,350	8	—
Mysore	32,000	—	—	32,000	—	—
N.W. Frontier	330	20,000	—	20,330	—	—
Patiala	285	—	—	285	—	—
Punjab	3,600	136,700	16,000*	264,500†	5	Also small canal falls during part of year.
Sikkim	8,000	—	—	8,000	—	—
Travancore	530	—	—	530	—	—
United Provinces and Benares ...	5,400	12,000	8,300	37,600‡	28	Also vast power in Himalayan rivers, and canal falls, available for nine months.
Round totals	181,400	631,300	840,600	1,774,000	over 135	—

* Excluding Indus, &c. † Including 108,200 H.P. canal falls. ‡ Including 11,900 H.P. canal falls.

In this connection, the largest of the numerous maps presented with the Report is of special interest since it shows (for the whole of India, including Burma) rivers, railways, and contours; sites of water power developments (developed, under construction, investigated, probable sites, and possible sites not examined); also, indications as to the occurrence of coal, oil, and various minerals required for the above-mentioned industries. At the present stage of the survey, the map is naturally incomplete, but it is already of the greatest interest, and demonstrates the limitless possibilities of industrial electrical engineering in India.

Apart from new industries such as those mentioned, and apart from ordinary town supply for electric lighting, heating, fans, tramways, and hill railways, there are many industries in which cheap electric power would be welcomed. For instance, in a comparatively small area of the Duars, within easy reach of water power (the Jaldaka), it is estimated that fuel equivalent to a working load of 100,000 H.P. is used in the tea factories, partly for steam engines, but mainly for drying with hot air and fans. Both the motive power and hot air could be obtained electrically, it being merely a question of comparative costs. The Tata scheme now serves most of the cotton mills of Bombay, replacing steam engines, and similar results may be obtained in jute mills, oil mills, timber working, sugar production, paper pulping, and other industries.

As regards irrigation, it is unlikely that electric pumping would pay on any water rate that could be demanded, where the lift is at all great. The overall efficiency from water falling to water raised, in an electric pumping plant served from a hydroelectric station, is about 50 per cent. under the best conditions, assuming 2 cu. ft. per sec. to be pumped against 100 ft. head, and allowing 10 per cent. transmission losses and suitable values for turbine, generator, motor, and pump efficiencies. If the lift of the pump were 10 ft. instead of 100 ft., ten times the acreage could be irrigated for the same power expenditure, and the proposition would become more practicable.

Water-power Resources of India.

It will be several years before the total possiblities in the way of Indian water power can be determined even approximately. In the meantime, all estimates must be accepted with great reserve, particularly if they emanate from individuals or bodies not thoroughly *au fait* with Indian conditions. The long dry season and the geological characteristics of areas on which an enormous rainfall is received during the monsoons, render practically useless many sites which might be thought capable of yielding even millions of horse-power. Well advised warnings on this phase of the subject are given in the Report, together with a number of tables setting forth the leading features of existing hydroelectric plants in India and (where known) of sites examined but not developed. Though yet far from complete, it is no exaggeration to say that the information given concerning sites in the various Provinces is of the highest importance, and this information, together with the general notes on conditions in each Province, should be studied by British engineers and manufacturers no less than by those in India. This Report is one which will not be overlooked by our competitors.

The accompanying table shows that there is about 1,774,000 electrical horse-power actually in sight. *This total is, of course, vastly below the actual available power which the final results of the survey will disclose.* Thus there are over 130 possible sites to which attention has been drawn of which nothing is known definitely, and there may be hundreds more yet to be found. Also, the great perennial snow-fed rivers have scarcely been touched upon. Their potential power has not been determined, and is in no way included in the table, except as regards a few definite projects. Allowing for the reducing effect of seasonal discharge on the continuous output available, many millions of horse-power could be obtained continuously from the Himalayan rivers *if cost were no object*. Thus the combined *minimum* flow of the Indus, Jhelum, Chenab, Sutlej, Beas, Jumna, and Ravi rivers exceeds 36,000 cu. ft. per sec. where they enter the plains (at not more than 1,500 ft. above sea level). This is equivalent to 3,000,000 E.H.P. per 1,000 ft. of fall, and these rivers and their tributaries rise at levels up to 20,000 ft. or more. Similar considerations apply to the Ganges, Sarda, Brahmaputra, Irrawaddy, and Salween. The total power on the minimum discharge is incalculable, and on the normal discharge during the greater part of most years it is several times as great. How much of this power is worth developing is purely a matter of relative cost; a considerable part of it could doubtless be developed commercially at any time.

The Future of the Hydroelectric Survey.

In his remarks on this subject the Chief Engineer to the Survey emphasises the scope and importance of the work yet to be done, and makes suggestions for procedure calculated to promote efficiency and avoid official delays. It is indeed to be hoped that, in the absence of specific demands for power in a particular district, the all-important survey work will not be shelved. For too long and in too many places has industry waited for power what time power was waiting for an assured load. Survey work in the field of water power cannot be hurried, and in the failure to inaugurate a system of records at the time of the first Indian water power inquiry of 1905, we have a tragic example of fourteen years lost to investigations, the cost of which would have been as nothing to the value of the records which they would have furnished by this time.

What is required in India—and in every other part of the Empire for that matter—is a simple but definite census of power; a reliable and comprehensive record of rainfall; observations of normal, minimum, and flood discharges of rivers, and determinations of run-off; a general reconnaissance of all water-power sites (relatively superficial in the first place in order that the general prospects and relative merits may be determined before proceeding to detail work); a specific survey of approved sites; and sound training courses in hydroelectric engineering.

Under each of these headings Mr. Meares makes practical suggestions primarily applicable to India, and his proposals as to the lines upon which the Survey should proceed in the various Provinces will probably be found to include all the major water-power developments in India within the next ten years.

It is to be hoped that the Hydroelectric Survey of India will proceed in accordance with the broad and far-seeing policy under which it has been inaugurated, and that this masterly Preliminary Report will receive the attention which it deserves in the engineering and industrial circles of the Empire, and in the colleges, whose students will be responsible for so much of the staff work in developing Imperial water-power resources.

[The report can be obtained from the usual agents of the India Office, such as Messrs. Eyre & Spottiswoode.]

A Cry from the Soul.—We recently read the following, which had been typed and pinned up in an office:—"Our business has been established ever since 1858. We have been pleasing and displeasing people ever since. We have made money and lost money. We have been cussed and discussed, knocked about, talked about, lied about, held up, robbed, &c., to the end of the chapter. The only reason why we are staying in business is to see what the —— will happen next."—*The British Westinghouse Gazette.*

CO-OPERATION.

We abstract below, from the *Journal* of the American Institute of Electrical Engineers, Prof. C. A. Adam's presidential address before that Institute:—

Since the last annual Convention of this Institute the greatest war in the world's history has come to an end. Widespread dissatisfaction with the old order prevails in nearly all of the countries involved in the war. Unrest is generally prevalent, and, however unreasonable the demands of the restless may seem, there probably *is* a reason. In any case "it is a condition, not a theory, that confronts us." The old order has failed and can never wholly return. Are we as engineers going to crawl back into our little cabins and leave the steering of the ship to those we consider incompetent? Or are we going to ask the same question we ask when our engineering plans result in failure, namely, why? This year the important question of Institute activities and policies is receiving a thorough discussion through our Development Committee. The subject of co-operation to which I wish to call your attention has a decided bearing on several important institute functions. My reason for selecting this subject is partly because of my recent experience in applying the principle, but more because the broad application of the principle seems to offer at least a partial answer to the questions propounded above, and also because this application is of peculiar interest to the engineer. I do not propose any revolutionary programme, but merely the hastening of the natural evolutionary development by the application of a little perspective and common sense. Industrial co-operation usually involves co-operation all along the line, internal and external, between producers, between consumers, and between producers and consumers. The obstacles to co-operation, particularly between the larger units, are of two varieties, material, and human or intellectual. The chief material obstacles are space coupled with imperfect means of communication and transportation, differences in language, differences in coinage, weights and measures, and duties or tariffs. Some of these bear only on international co-operation. The chief intellectual obstacles are tradition, custom, prejudice, suspicion, distrust, jealousy, narrow minded and short sighted selfishness or greed, or in general ignorance and lack of understanding one of the other. Most of this latter group bear upon minor or internal as well as upon international co-operation. It is my desire not only to point out the importance and value of co-operation, but also the part that we as engineers can play in helping to break down these barriers.

Standardisation.—The work of the Standards Committee of this institute is second to none, in spite of the fact that the ground covered is a peculiarly difficult one. This success is simply due to the co-operative spirit which has prevailed. Conflicting interests come together, and finally agree to abide by the resulting rules. Thus it is an asset of no mean value to the industry and to the nation as well.

But this co-operative spirit does not always prevail. Until very recently the French National Committee of the International Electrotechnical Commission contained no designing or manufacturing engineers; it being assumed that the latter would be biased and partisan in their attitude. As a result the manufacturers formed a syndicate with a committee and standardisation rules of its own, which were and even now are to some extent the rules generally employed in France although much inferior to our own. In some cases the American rules are specified. Even now the French rules originate in the Manufacturers Syndicate and are passed on to the French National Committee for approval, with a consequent loss of time and efficiency.

As the work of our own Standardisation Committee expanded we found it overlapping the work of other societies in adjacent fields, and co-operative relations were established. This failed from the lack of any suitable and generally acceptable co-operative machinery. A movement was then started by the institute more than two years ago to organise a central body (the American Engineering Standards Committee) to co-ordinate all the work of engineering standardisation being done by the various engineering organisations. International standardisation will be a tremendous stimulus to foreign commerce; but such international standardisation is in most cases exceedingly difficult without a central authoritative body with which similar foreign bodies may co-operate. Several instances of this difficulty which have actually arisen during the past two years could be cited. These have resulted in hopeless confusion, misunderstandings, and waste of time and money. Great Britain has its Engineering Standards Association which, during its eighteen years of life, has demonstrated its reason for existence and its value. France now has its Permanent Standards Commission a little more than a year old, and just getting under way. Holland also has its Normalisation Bureau for the same purpose, and Switzerland is just starting a movement in this direction. With all these national bodies our American Standards Committee has already established cordial co-operative relations. The American Engineering Standards Committee, although organised last October, is now in process of reorganisation. But the success of any such movement is in direct proportion to the degree in which the co-operative spirit prevails, and the two years spent before the first organisation, and the present delay in the reorganisation is due largely to some of the obstacles to co-operation mentioned in the second group above.

It is the generous co-operative spirit for which I am pleading, rather than the timid, fearful spirit of him whose vision it of such short range that he dare not take a man's size step for fear of stubbing his toe, who holds the little present so close to his eye that it shuts out the whole landscape of the future, whose immediate self interest or small-group interest is so dominant as to hide anything beyond. The man who never makes a mistake never gets far. I am not advocating slap-dash methods, but rather more of the positive and less of the negative attitude, more constructive and less destructive criticism, more of the forward-looking progressive spirit, and less of the visionless, timid, reactionary spirit.

Research.—Another fertile but as yet little cultivated field for co-operation is that of industrial research. Here we have a field where the obstacles of the second group are specially dominant, particularly short sighted self-interest and corporate interest, and the timid desire for secrecy. That many of the most important and revolutionary developments of modern industry are dependent upon research needs no proof. It is not so obvious to many however that co-operation in industrial research is to any large extent feasible at the present time. First the line often drawn between scientific and industrial research is a very hazy one. In other words, the difference is one of purpose rather than of method. But I think that, particularly since the war, most of our so-called pure scientists have become greatly interested in the industrial value of their scientific work.

I am fully aware of the difficulties arising from patentable developments, but these can readily be handled by suitable agreements between the parties to the co-operation. I am convinced that thorough going co-operation in industrial research would mean not only a reduction of the cost of research to a small fraction of its present figure, a much more rapid industrial development of the country as a whole and a material increase in the productivity of labour, but also an increase in the profits of every intelligent party to the co-operation. It is not so much a question of altruism as of a far-sighted self-interest and patriotism.

Serious co-operation of any kind between widely separated groups is practically impossible without the mechanism of transportation and communication provided by the work of the engineer. Also with this mechanism developed even to its present degree of perfection, co-operation becomes not only possible but also desirable and necessary, even between comparatively widely separated groups. Moreover, the problems which confront the world at this time are largely a direct result of this mechanism. Are we as engineers going to leave their solution to others? Are we going to fail to take an interest in our neighbour who has much that we need, from whom we have much to learn, and, by co-operation, with whom we can profit broadly? If we do offer co-operation is it to be with the provision that we gain all and sacrifice nothing? Are we going to be satisfied to criticise destructively when the issue at stake is in some cases of such paramount importance (had we only the vision to see it) as to overshadow our very existence?

Now just a word as to a specific and very serious problem, namely, that arising from the world-wide unrest in the labour group. To ignore this condition is suicidal. It is difficult to characterise this condition in a few words as there are so many degrees of radicalism and of revolutionary spirit represented; but it may be safely stated that, on the average, labour is unreasonable in its demands, or at best it has an exorbitant idea as to the value of what it creates. There seems to be a prevailing notion in labour circles that the excess profits of the capitalist constitute a limitless supply which only needs the tapping. It is very easy to criticise and condemn this attitude, and to assume that it is merely a matter of showing the labourer the error of his ways and of forcing him into line. But would it not be wiser at this time to examine our own attitude with equal care, to make sure that we are setting an example which if followed by labour would solve the problem? Is demanding all that the traffic will bear under the pressure of organised labour any worse than the same policy carried out by the capitalist whenever he has the monopoly grip? Unfortunately the two cases are not treated the same by our laws; labour monopoly is not subject to the same limitations and responsibilities as is capital monopoly; that disparity should be removed. But there are two forms of monopoly other than of labour which are not only limited by but are actually fostered and protected by our laws, and in which the only limitation ever dreamed of by the owner is, "all that the traffic will bear"—these are patents and titles to land. Our patent system has a worthy motive, but it is often a matter of pure accident as to which of two men who have conceived the same idea at about the same time reaps the reward, and it often goes to the less worthy. Often the originator of an idea makes a much less important contribution than the man who makes it a commercial product. This is another realm in which broadgauge co-operation would eliminate many of the unfair and gambling aspects of the patent system, and distribute the rewards in a much more equitable fashion.

Of all sources of monopoly our present land system is the most unfair, the most dangerous, the most far reaching in its influence. Under it a land owner is paid a premium for

holding valuable land idle, for forcing a community to spend its money in building around his land, and to take its time to travel around or past his land. Private ownership of land seems to me desirable, it has a wholesome stabilising influence, and the injustice of our present system can be largely removed without sacrificing any of the real advantages of private ownership by taking for the community what the community creates, and leaving to the individual what he creates, by shifting taxation from industry to privilege. I touch upon this subject only as one of a group of suggestions as to possible ways in which we can assist in progressive rational evolution of society rather than encouraging and inducing a revolution by a reactionary policy.

What can we expect of labour in the way of intelligent fairmindedness if we, with our superior advantages encourage the perpetuation of institutions which work for serious injustice to the many for the benefit of the few, or even if we allow them to persist because of our lack of intelligent fairmindedness. My opinion as to the seriousness of the present world situation, as to the importance of the problem before us, is not mine alone, but that of many thinking men in this country and in others. I have talked with many influential men in France and England, and have found a striking unanimity on this point. May we not as engineers utilise our training and experience, our method of thought of which we are so proud, to encourage clean, straight, unbiased and fairminded thinking, and to encourage that broad generous co-operative spirit which will mean so much in breaking down the barriers which separate classes within a nation, as well as the nations themselves, and which is essential to the solution of the world problem which is knocking so hard at our door.

THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The plenary meeting of the International Electrotechnical Commission was held on Wednesday, October 22nd, with Monsieur Maurice Leblanc, president, in the chair.

It was unanimously decided to re-appoint the advisory committees (formerly called special committees) which were at work before the war, and to appoint some additional committees, as follows:—

Nomenclature.—The Advisory Committee on Nomenclature was reappointed with one delegate from the National Committee of each of seven countries. The committee was requested to consider the terms and definitions which were agreed in 1913, and to deal with those which were considered to require revision at the present time, the remainder to be published at once. The committee was then invited to continue the work and also to prepare terms and definitions for automatic telephone apparatus.

Rating of Electrical Machinery.—The Advisory Committee was renominated with one delegate from each of seven countries. It was agreed to publish the rules relating to the rating of electrical machinery agreed upon at the last meeting and modified in accordance with recent decisions.

A cooling air temperature of reference of 40 deg. C. (the figure already adopted in the British, American, French, and Italian rules) was adopted unanimously. It was also agreed to limit the scope of the present rules to machines up to 750 K.V.A. or 5,000 volts, or armatures 50 centimetres in length; the use of thermometer methods of measuring temperature under certain conditions, in cases where resistance methods only were formerly permitted, was agreed upon. These international rules will shortly be published.

Symbols.—The Advisory Committee on Symbols was reappointed with ten members, and, in addition to revising the I.E.C. publication No. 27 on symbols, was invited to prepare a list of graphical symbols, including those for ordinary and wireless telephony and telegraphy.

Nomenclature.—The Advisory Committee on the Nomenclature of Prime Movers for Electrical Purposes was renominated with seven members, and was requested to get agreement with regard to the nomenclature of steam-driven prime movers.

Aluminium.—An Advisory Committee consisting of eight members was nominated to study the question of the adoption of an international standard of resistance for aluminium; it was desired that the lines adopted for the preparation of the standard of resistance for copper should be closely followed.

Screw Lamp Caps and Lamp Holders.—An Advisory Committee consisting of seven members was nominated to study this question; it is understood that the report of the committee will deal only with the question of international interchangeability, the question of material not being dealt with.

Charging Plugs for Electrical Vehicles.—An Advisory Committee consisting of six members was nominated to deal with this subject. In this case also the question of interchangeability only is concerned; it is understood that the charging plugs employed in the United States and Great Britain for this purpose are identical.

Pressures for Distribution.—An Advisory Committee consisting of ten members was appointed to consider this question. It was agreed to consider first of all a series of pressure steps for insulators in accordance with the proposals of the Italian Committee, and subsequently to consider the subject more generally.

At a meeting of the Council of the Commission, Dr. C. O. Mailloux, president of the American National Committee, was unanimously elected the new president of the Commission, and its success has been due in no small measure to his efforts on its behalf. His great linguistic abilities have been of the utmost service on many occasions.

The Council accepted the invitation of the American Committee to hold the next plenary meeting in America during 1920.

At the close of the meeting, Dr. Mailloux, on behalf of all the delegates, presented a silver cup to Col. R. E. Crompton, the "father" of the Commission.

In our report of the proceedings of the Commission on Tuesday last week the name of Mr. F. Ayton, one of the British representatives, was inadvertently omitted.

NOTES FROM CANADA.

(From our Special Correspondent.)

A certain small town in Ontario, by name Goderich, seems destined to become better known before many years are past, as it is reported that the Lake Huron Steel Corporation, which is financed by American capital, will spend $2,000,000 there in the next twelve months on an electric steel plant.

The company intends to install six Héroult electric furnaces, and later, during the succeeding twelve months, to spend $6,000,000 on blast furnaces; besides this equipment there will be a blowing mill, a rod mill, and a bar mill for the production of high-grade steel billets, rods, bars, and ferro-alloys for the manufacture of automobile parts and general commercial purposes.

It is stated that the company will use 14,000 H.P. to start with, rising to a maximum of 20,000 H.P., which will be obtained from the Hydro-Electric Power Commission of Ontario; altogether it expects to find employment for 4,000 persons.

With reference to the establishment of works in Canada by Americans, H.M. Imperial Trade Commissioner at Toronto (Mr. F. W. Field) in a report on the "Trade of the Province of Ontario" for 1918, has the following to say:—

". . . the United States had established in Canada over 500 branch works, or assembling plants, large and small, representing an investment up to October, 1916, of $251,000,000. The greatest number of these branch works was in Ontario.

"For some years past, until 1918, this movement slackened considerably. During the year under review, however, it was given a decided impetus by the renewed discussions of an Imperial preference. The United States manufacturer in many cases proposes to secure whatever advantages may be forthcoming in that direction, by erecting branch works in Ontario, or in other parts of Canada, thus becoming, to all intents and purposes, a Canadian manufacturer. This is a matter which calls for the close attention of United Kingdom manufacturers, especially as the renewed activity along this line passed beyond mere discussion. . . . There are several good reasons why it is not possible for United Kingdom firms to follow this tendency to a similar extent. At the same time, with the more intimate interest which is being taken by United Kingdom firms in this market, it is suggested that in some cases it may be found desirable at least to survey the field with a view to the advisability of establishing assembling or other works in this area to meet at closer range the competition offered. . . . Every possible assistance will be given by Ontario Boards of Trade, industrial commissioners, and municipalities to firms who contemplate the suggested action. Municipalities, in several instances, make substantial concessions to manufacturers building their works within the municipal borders, such, for example, as free sites, reduced taxation, exemption from taxation, cash bonuses, and water supply at low rates."

Mr. W. E. Anderson, the Imperial Trade Commissioner at St. John, New Brunswick, writes as follows under the heading: "United Kingdom Manufacturers' Opportunity":—

". . . We were brought up sharply with an acute realisation of what the United Kingdom meant to Canada. No advertising campaign, no matter how well prepared and carried through, could have done so much to turn trade towards United Kingdom channels, and a 'British-made Goods' advertising campaign in Canada, launched by United Kingdom manufacturers, would meet with an enthusiastic reception."

Several times recently the daily papers have referred to the water power available on the St. Lawrence river. This river for a considerable distance (about 113 miles) is an international one, both the United States and Canada having an equal share in the advantages which it affords in respect of navigation and water power. Any action affecting the river in this particular section of its length, which extends from the eastern end of Lake Ontario to Cornwall, must be taken up jointly by the two countries.

Canada for several years past has been advocating the development of the enormous water power which could be made available in this section, but has been unable to make any move because no collaboration in such work could be obtained from the United States. Now, however, it is announced that the United States Government, acting upon instructions from Congress, has asked Canada to be a party to the submission of the question to the International Joint Commission, which is composed of representatives of both countries, so that a report may be obtained upon the feasibility, desirability, and cost of such an undertaking. It is understood that the Canadian Government has already consented to associate Canada with the reference, and both Governments have named representatives, who will prepare the questions which must be considered by the International Joint Commission. The appointee of the U.S. Government is Lieut.-Col. Charles Kellar, of the War Department, and W. J. Stewart, the Dominion Hydrographer, will represent Canada.

In this matter not only is the question of water power to be considered, but also that of navigation, which, in accordance with the terms of a treaty between Great Britain and the United States, takes precedence of water power, and it is stated that many interests in the interior States of the United States have realised the importance to them of a deep waterway from the head of Lake Superior to the Atlantic, and the new Welland Canal, which the Dominion Government is now constructing across the Niagara Peninsula (approximately paralleling the Niagara river) will be a big factor in this means of communication.

Both navigation and water-power possibilities are to be considered by the International Joint Commission, and whatever may be done with regard to the former, it is certain that given proper engineering an immense amount of power can be generated from the waters of this great river in this portion of its length.

In connection with this same subject, the Premier of Ontario, Sir William H. Hearst, intimated that a solution of the problem of developing power on the St. Lawrence river on a large scale would be found in the very near future, and added that he believed that before long there would be large development works there, so that the St. Lawrence would be the great source of power for Eastern Ontario, helping to make this section of the Province a great industrial centre.

For some years past the Hydro Electric Power Commission of Ontario has been collecting detailed information about the various possible sources of power supply (hydraulic) within the Province, but an arrangement has recently been made between the Minister of the Interior (Dominion Government) and the Commission referred to whereby a thorough investigation of the water powers of Ontario will be made.

This arrangement, which provides for co-operation between the Dominion Government, through the Water Power Branch of the Department of the Interior, and the Hydro Electric Power Commission of Ontario has been ratified by a Dominion Order in Council, according to the daily Press, and survey work is to be begun without delay.

THE GATUN HYDROELECTRIC STATION.*

In the original construction of the hydroelectric station at the Gatun lock spillway on the Panama Canal, the capacity of the generators installed was 6,000 kw. Provision was made for the installation of three future units aggregating an additional 6,000 kw., which would double the plant, giving a proposed capacity of 12,000 kw. Through the increase in consumption of electric power along the canal it has been necessary to increase the capacity of the plant beyond the original maximum estimate. The plant has now a capacity of 13,140 kw., and provision has been made for the future installation of two more units of 4,500 kw. each, giving an ultimate capacity of 22,140 kw. The developments were made while the plant was in use, and with no interruptions of the service, says the *Journal of Electricity*. An interesting feature was the change, at the same time, in the operating or bus voltage, which was raised from 2,200 to 6,600 volts for transmission to the sub-station at Gatun and subsequent distribution at 44,000 volts, to the other sub-stations of the transmission system. The voltage from the three original generators was raised by the installation of auto-transformers while the new unit generates directly at the 6,600-volt station pressure. The switchgear and connections were revised as necessary in connection with the increased voltage.

The station was first placed in service during July, 1914, and in January, 1915, after completion of the transmission lines, the entire load on the power system was transferred to this plant. The original capacity of the station was 6,000 kw., divided into three units of 2,000 kw. each. Shortly after the station had been placed in service the steam station at Miraflores had to be used to help carry the load. During the latter part of 1916 the original water wheels were taken out and replaced by wheels of a different design and slightly increased size; a certain section of the turbine casing being bored out to allow the larger size wheel to be used. This change in the three original units increased the capacity of the latter to 2,880 kw. each, and the capacity of the station as a whole to 8,640 kw., a total of 2,640 kw., or 44 per cent.

The completed studies of the power situation showed that the limit of capacity of the station, if enlarged only to the extent of the original plans (*i.e.*, 17,280 kw.), would be reached and possibly exceeded in a short time. Final study of all details proved that the extension of this station could be made by the installation of three units of 4,500-kw. capacity each, which would increase the ultimate capacity of the station to 22,140 kw., and the final extension was carried out as indicated above. The requirements of the power system did not call for the complete installation of all three units at once, and the installation of only one of the 4,500-kw. units was accomplished. The actual work on this extension was started in December, 1916. In order to deviate from the plans as originally made, certain changes and modifications had to be made in the original equipment and general layout of the station.

The draught tubes of the original turbines were of steel embedded in the concrete foundation. The new tubes are of concrete, and made an integral part of the foundation structure.

On account of the increased volume of water changes had to be made in the design of the tail-race, penstocks, and headgate structures.

The original units in this station developed 2,880 kw., at 2,200 volts, and 250 r.p.m. Each unit had an exciter mounted on the main shaft. The oil pressure for operating the governor was 80 lb. The new units, as installed, develop 4,500 kw., at 6,600 volts, and 187.5 r.p.m. The oil pressure is 150 lb. No exciters were mounted on the shafts of these new units. The original oil pumps were replaced with new ones. The old governors were originally designed to operate satisfactorily at this higher pressure. Tests were conducted to check this latter detail. When the change in pumps was made, the type of motor was also changed from a.c. to d.c. This change improved certain operating characteristics of the station. Changes were also made in the type of governor drive on old units to conform to that on new units. With the exception of minor mechanical details and increased capacity, the new units are of practically the same general design as the old ones.

The excitation current for the original station was furnished by two 100-kw. induction motor-driven exciters, and three 50-kw. exciters mounted on the shafts of the main units. The motor-driven exciters were used for normal operation, and the shaft-driven ones for emergency use. Additional exciter capacity was provided for by the installation of a 275-kw. turbine-driven exciter. This is a unit complete in itself and supplied with water from a 40-in. connection to two of the 12-ft. penstocks. Valves were installed so that the unit can be supplied with water from either main penstock. The installation of this unit provides a main source of excitation for the station that is complete in itself and cannot be affected by any other trouble that might develop in the station.

The extension of the control board was carried out along lines similar to those of the original equipment. One exciter panel and three generator control panels were installed. The rheostat equipment on the old section of the board was rearranged and other changes in detail were made to conform to the new section of the board. Voltage regulator equipment was rebuilt, and adapted to the new equipment. Advantage was taken of the opportunity offered while this work was in progress to make changes in minor details of the control board which improved the general operating characteristics of the station.

The station was originally designed and operated at 2,200 volts, all the switchgear and bus equipment being standard for that operating voltage. Changing the station over to the increased bus voltage of 6,600, required practically the complete reconstruction of all this equipment. Auto-transformers were installed in the basement, and generator leads were connected direct to them. These transformers increased the voltage of the old units to 6,600 volts, and no provision was made for future operation of these machines without the auto-transformers. The 6,600-volt leads from transformers were carried to the station bus through main and auxiliary bus switches. Changes were made to the old 2,200-volt bus and the structure was extended on through the new section of the building. The 2,200-volt outgoing feeder equipment was formerly located in the old section of the building. The outgoing 6,600-volt feeder equipment was installed in the new section of the building. This equipment being of an entirely different type, it was necessary to construct a complete set of new type switch compartments, and slightly different bus layout; the old 2,200-volt outgoing feeder equipment being completely removed and diverted to other uses in the sub-stations. The reconstruction of switch gear and bus layout in this station was the most difficult detail to accomplish as the station had to be kept in continuous service while work was going on. The raising of bus-voltage at the hydroelectric station necessitated corresponding changes being made at the

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*The electrical equipment of the Panama Canal was described in the Electrical Review of February 13th and 20th, March 20th, and August 21st, 1914, and April 2nd, 1915.

Gatun sub-station, where power from the generating station is fed into the 44,000-volt transmission system. The work had to be carried forward together so that the final change-over from 2,200 to 6,600 volts could be effected without interruption in service on any part of the power system.

The work at the Gatun sub-station which had to be done on account of these changes was the rearrangement of switch gear, installation of new type feeder equipment for incoming 6,600-volt feeders, and installation of 2,200-volt bus with power transformer equipment for handling local distribution of power from the main 6,600-volt bus. This included the power distribution to Gatun locks, which had formerly been supplied direct from the 2,200-volt station bus at the hydro station. A new 8,400-kw., 6,600/44,000-volt transformer was installed at the hydro station and the two original 4,000-kw. transformers that had been operating on the 2,000-volt bus were reconnected and placed in service at 6,600 volts. This work as a whole necessitated many changes in the general layout and details of this sub-station.

The actual change over from 2,200-volt bus voltage at the hydro station to that of 6,600 volts was accomplished without interruption in service on any part of the power system. The first stage was the completion of the 6,600-volt bus structure and feeder equipment in both hydro and sub-station, and the installation of the new generating unit and 8,000-kw. transformer in the sub-station. The changing over of old units was the second stage of the work. One unit at a time was taken out of service. In the meantime the work at the Gatun sub-station proceeded. The work as a whole was completed during November, 1918.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Right to Increase Charges for Electricity.

With reference to your article on the above subject in your issue of October 24th, the Provisional Order fixes the maximum charge for electricity to be charged by the undertaker, and subject to that the undertaker can charge whatever price the consumer agrees to pay, but it is entirely a matter of agreement.

If the undertaker serves notice that the price from a certain date will be 6d. per unit and the consumer takes electricity after that date, there is an implied agreement to pay 6d. per unit. But if the undertaker sells electricity at 4d. per unit, he cannot by serving a notice on the customer presume a contract or agreement to pay 6d. for what he has already sold at 4d.

The Statutory Undertakings (Increase of Charges) Act gives the Board of Trade power to raise the price mentioned in the Provisional Order, but gives no power to the Board of Trade or undertaker to presume an agreement. Therefore the undertaker has no power to charge for electricity consumed at 4d. an increased price of 6d. per unit, and he must serve notice on his consumer that the price will be increased from a certain date, and only charge the increased price from that date.

Lex.

October 25th, 1919.

Particulars of Plant for Sale.

May I suggest that advertisers of plant for sale in your journal should give fuller particulars in their advertisements? For instance, one frequently sees A.C. motors for sale, stating perhaps capacity, voltage and speed, but omitting phase and frequency.

A little more care in wording advertisements would save both advertisers' and inquirers' time and money.

B. W. Gothard.
Electrical Engineer.

Electricity Works, Farnborough,
October 27th, 1919.

Third Harmonics in Generator Windings.

I notice that Mr. L. C. Grant, in his interesting article on the above subject in your issue of October 17th, recommends, in the case of generators running in parallel, the earthing of each neutral point through a separate resistance. Such an arrangement suffers from the serious disadvantage that the value of the current which will flow into an earth fault has not a predetermined value, but varies with the number of generators which happen to be running at the time.

The disadvantage of running with only one neutral earthed is that the operator may omit to transfer the earth connection when taking the earthed generator off the bars. On the other hand, as pointed out by Mr. Grant, with a modern generator the third harmonic is little to be feared, even when the neutral points are all connected to a common earthing bar, which is itself earthed through a resistance. If, however, trouble is feared from such a cause, a comparatively low resistance may be connected between each neutral point and the earthing bar without doing away with the advantages of the single earth connection.

Mr. Grant suggests that when earthing each generator separately reactances might advantageously be used owing to the greater impedance which they would impose in the case of the third or any higher harmonic. It must not be forgotten, however, that one very important advantage of earthing the neutral point is that surges and resonance effects are *damped out* if an ohmic resistance is used, whereas a reactance merely reflects them. Again, in the case of a fault the earth current flowing through such a reactance represents a large amount of energy *stored up* which, when the breaker opens, is suddenly returned to the system and may set up serious over-pressures. For this reason an ohmic resistance is very much to be preferred to any form of reactance.

Kenelm Edgcumbe, Major, R.E. (T.).

London, *October 27th*, 1919.

Cardiff as a Centre for New Works.

Referring to the note on this subject in the current issue of the ELECTRICAL REVIEW, I am enclosing extracts from the *Western Mail* of Friday last, from which you will be able to judge whether the present controversy over electric power at Cardiff is conducive to the trade development of that city.

October 20th, 1919. **N. P.**

[The cuttings indicate that for no less than 17 years the City Council and the Cardiff Railway & Bute Docks Co. have been at issue as to the supply of electricity within the company's large estate. According to Mr. Arthur Ellis, the city electrical engineer, the Council has from the first been desirous of laying cables for the purpose, but apparently the company has imposed impracticable conditions, and nothing has been done. Now, it appears, urged on no doubt by pressure from the large firms at the docks, the company is asking the Council to lay mains in the area, but demands excessive payments for wayleaves, and refuses to take a bulk supply and distribute it by its own mains. If the Electricity Bill is passed, Mr. Ellis points out, such wayleave payments will no longer be necessary. The *Western Mail*, without expressing an opinion as to which party is in the wrong, urges that the question should be submitted to arbitration, and stigmatises the dispute as a disgrace to the city. According to one of our "Lighting and Power Notes" to-day, the company has now waived its demands.—EDS. ELEC. REV.]

WAGES IN ELECTRICITY WORKS.

ON October 20th the Court of Arbitration gave an award in the case of the Wycombe (Borough) Electric Light and Power Co., Ltd. The parties to this reference were the company above named and the Electrical Trades Union. The question submitted was as follows:—

"What is the prescribed or substituted rate applicable to the Union's members in the employment of the Wycombe (Borough) Electric Light and Power Co., Ltd., the Union's contention being that the 12½ per cent. bonus payable under Sir George Askwith's decision dated January 7th, 1918, forms part of such prescribed or substituted rate?"

The matter was referred under the Wages (Temporary Regulation) Acts, 1918 and 1919, by the Ministry of Labour to the Court of Arbitration for settlement, and representatives of the parties were heard on October 14th, 1919.

The firm submitted a schedule showing the names of the employés, their pre-war rates, and the various advances in those rates made since 1914. It appeared that different methods were adopted in settlements with the men; in the cases of some men who joined the Army their rates were adjusted on their return to yield advances of 28s. 6d. or more with 12½ per cent. added; in other cases the increases were such as to give the men concerned the equivalent or more of advances on their pre-war wages of 28s. 6d., plus 12½ per cent., whilst in some few cases the increases did not reach the equivalent of such an advance. Many of the advances were made in January, May, July and December, 1918, and a later advance was made in 1919.

The finding of the Court was that there was no prescribed rate in the district applicable to the class of employés to which the men concerned belonged. Having regard to all the circumstances shown at the hearing, the Court expressed the view that minimum rates should be established, which would give to each of the adult male employés concerned an advance over the pre-war rates of 28s. 6d. a week, plus 12½ per cent. on earnings, or the equivalent of such an advance.

The award was signed by Messrs. David Harrel, J. Duncan Elliot, and James Gavin.

A Chilean Invitation to Germany.—The Chilean Government has announced its decision to send propaganda pamphlets to Germany with the object of encouraging German-Chilean trade.—*The Times.*

LEGAL.

Josephs v. Kelly & Kelly.

In the Shoreditch County Court, on October 23rd, before Judge Cluer, Annie Josephs, of 163, High Street, Shoreditch, fur skin dresser, sued Messrs. Kelly & Tarshes, of 5, High Street, Shoreditch, electrical engineers, to recover £24 damages in connection with the installation of a motor of 3 H.P., with starter and pulley, guaranteed. Mr. Josephs went into the box and said he managed his daughter's business. Judge Cluer: You are a bankrupt? Witness: I am not a bankrupt. Judge Cluer: Humph! Well, then, you are not in a position to pay your creditors, or the business would be yours. Witness went on to say that the electric motor was for the purpose of driving a fur skin dressing machine. It did not go right from the start, and he kept asking them to see to it, until finally he demanded back the £40 he had paid for it. Defendants then said it wanted re-winding only, and did it, but it did not improve. It was then decided to have the thing put in order by another firm, to whom they had paid £24 7s. 6d. They also asked for £3 which had been paid over the contract price, £27 7s. 6d. in all. The defendants did not appear, a letter being sent to say that Mr. Tarshes was ill in bed with influenza. Judge Cluer said that did not prevent Mr. Kelly or someone from the firm coming. Mr. A. J. Barlow, of 9, Brunswick Place, City Road, electrical engineer, said the armature was wrong besides other things, which he put right, and he had been paid £24 7s. 6d. Judge Cluer gave a verdict for the plaintiff for £27 7s. 6d., and costs.

An Unfenced Electric Crane.

Henry White & Co., Ltd., of Pontymister Foundry, Risca, were fined £50, including costs, at Newport (Mon.) for not fencing an electric crane in the moulding shop, in consequence of which neglect a man named Hardman was killed in September last. Mr. Price, one of the staff of the inspectorate, said he found it was very hard to convince managers of works that the factory inspector knew anything about dangerous machinery.

Charge of Embezzlement by Tramway Official.

At the Manchester City Police Court, on October 24th, the hearing was resumed of the charges against John William Hewitt, aged 43, of embezzling two specific sums of £693 and £617. Mr. A. F. Pickford, who prosecuted on behalf of the Manchester Tramways Department, said that the total sum involved was over £5,000.

In opening the case for the prosecution, Mr. Pickford said that he prisoner was the cashier in the tramway department, and had the handling of the money that was taken each day in passenger fares and for the delivery of parcels. He was also the person who ultimately received cheques for various amounts due to the department, such as for rent of lines by other authorities and payment for electrical energy. The ticket superintendent (Miss Hunter) made up each morning the cash takings of the previous day. The Treasury notes and the silver and coppers were handed over to Hewitt or his representative, and a traffic receipt was made out in triplicate signed by prisoner or a deputy. The silver and the coppers were checked at the time and then put into boxes, whilst the Treasury notes were handed over to Hewitt. As a counter-check the ticket superintendent sent to the financial superintendent an independent statement of the amount handed over to Hewitt, and this corresponded with the amounts entered in the receipt book. The financial superintendent would then enter into the receipt book certain additional amounts Hewitt had received according to the receipt counterfoils. The financial superintendent then got the pass-book from the bank each day and checked the amount paid in by the prisoner with this statement.

On September 24th last, said Mr. Pickford, a cheque for £693 odd was received by the financial superintendent from the Salford Corporation, made payable to the Manchester Tramways Committee. Mr. James Wood, the financial superintendent, passed the cheque over to Hewitt, and it was the latter's duty to enter a receipt for the cheque and pay it straight into the bank together with his cash received that day. As a matter of fact, the prisoner kept the cheque for a few days and paid it into the bank on September 29th, but still failed to account for it in the receipt book. Up to the present time, in fact, there was still no entry of that cheque in the receipt book. He paid the cheque in on September 29th, and kept out a corresponding amount from the cash which he had received from the ticket superintendent and the parcels superintendent, so that by paying in the cheque the pass-book corresponded with the amount shown on the independent statement. For that cash Hewitt had not accounted. On September 16th a cheque for £617 odd, also from the Salford Corporation, was handed to Hewitt, who paid the cheque into the bank and retained from the traffic and parcel receipts a corresponding amount as in the other case. In this instance also the amount was not accounted for. On October 15th a list of outstanding accounts by the Salford Corporation was submitted to the financial superintendent by a member of the staff, and on the following day a collector called and demanded payment. On his return he reported that the accounts had been paid and the cheques passed through the bank. The books were investigated, and it was then discovered that no counterfoil receipts had been made out, and that the Salford Corporation accounts were shown as unpaid. On October 17th, Hewitt confessed that he had had the Salford money, and that the total amount of the deficiency in his accounts was approximately £5,000. Mr. Pickford added that the amount of the defalcations that had come to light was a little over that figure.

Corroborative evidence having been given by Mr. James Wood, the prisoner was remanded until October 30th, bail being refused.

Bartlett v. Warner.

In the King's Bench Division, on Monday, Doris W. Bartlett, of Wimbledon, brought an action against Mr. F. Warner, managing director of the Notable Electric Co., of Merton Park. Counsel for plaintiff said that she was a photometer hand, and in May, 1918, defendant informed her that he had decided to dismiss her because business secrets had been leaking out, and she had been seen talking to a Mr. Dixon, a former employé. Mr. Justice Lawrence held that there was no case, and he gave judgment for the defendant with costs.

Elwell v. Universal Radio Syndicate, Ltd.

This case was heard before Mr. Justice Roche in the King's Bench Division on Monday and Tuesday. Plaintiff claimed for salary due under an agreement in writing dated July 31st, 1913, as varied on or about April 27th, 1915, for goods supplied to defendants, and moneys paid at the request of defendants. There was a counter-claim by defendants for an account of all orders received by the plaintiff for the supply or erection of wireless installations whilst in their employ, and of all profits received by him, also for damages for breach of contract, &c. After the hearing had continued for some time his Lordship suggested that there should be an agreement between the parties as to the mode of settling accounts, and after consultation between the parties, Mr. Goddard, for defendants, announced that the case had been settled. The record would be withdrawn. The plaintiff would pay a sum of money which need not be mentioned. Any imputations would be withdrawn. His Lordship expressed his satisfaction that a settlement had been reached. A report of the case will appear in our next issue.

BUSINESS NOTES.

A Birmingham Handbook.—We have received a copy of the City of Birmingham official *Industrial and Commercial Handbook*. It has been produced under the authority of the General Purposes Committee of the Corporation. It is an attractively got-up publication of some hundreds of pages, in which are set out particulars and pictures of features of the city, including public buildings and works. The industries of the city, such as hardware, metal trades, wire-working, motor, electrical and other engineering, &c., are described, and the various firms and their businesses are summarised. The industrial advantages of Birmingham in respect of factory sites, tramways, canal service, electricity, gas, and water supply are stated. An introduction to the book has been written by Alderman Neville Chamberlain, M.P.

Observations of an Exhibition Visitor.—A correspondent writes as follows:—"A recent visit to the Shipping and Engineering Exhibition leads us to believe that the value of such shows from a trade point of view is likely to be limited owing to exhibits being in charge of representatives who, while able to talk to visitors about the machine they are exhibiting, are not familiar with its merits as compared with those of foreign manufacture. It may be assumed that interested people from every part of the globe inspect the various models on view, and while many do not possess actual technical knowledge, they are commercially keenly alive to any advantages they may offer. It is, therefore, in our opinion necessary that representatives in charge of exhibits should be thoroughly conversant with their history and advantages over other machines of a similar nature, and be able to conduct an intelligent and aggressive salesmanship conversation. Well known as it may be that this country has a reputation for quality and excellence of manufacture, yet, in view of active competition by foreign manufacturers, it is not sound merely to rest on our oars and to be satisfied with such a reputation, but it is absolutely essential that someone should be able to discuss the advantages, superiority, economy, &c., with a possible purchaser, and for this purpose a representative must be familiar with similar types of machines or articles made abroad. The old attitude of 'This is our article, and if you do not like it, you do not know what you want' prevalent in pre-war days must cease. It must also be remembered that while this country can be proud of its reputation for quality, yet the manufacturers cannot ignore the cheap trade, and it was due to this that foreign countries gained a footing and also owe

their entry to the better class trade. This was fully demonstrated during the late Joseph Chamberlain's time when he arranged an exhibition in England of articles supplied to our Colonies by foreign nations and the packages in which they were sent. The attitude even then of British merchants was that they had no wish to be identified with such cheap productions, referring to the exhibits, but it must be borne in mind that unless Great Britain caters also for this class of trade, foreign or Colonial importers will be forced to go to the Continent of Europe, and this being so, they will also place their orders for the better class goods there, and get one consignment instead of several from different countries. Perhaps it would be well to give an example. Take an importer in South Africa or the West Indies. He caters for a huge coloured population as well as a lesser white one. Cheap goods must be on sale for the former, as their means are small and they cannot afford to pay for the highly finished article. Continental countries and the United States cater for this class of trade, and get it because Great Britain will not be identified with it, and there is no doubt, apart from the question of keeping machinery running and giving employment with perhaps little profit, the cheap trade sprat lands the better class trade mackerel."

Merchandise Marks Committee.—The President of the Board of Trade has appointed a Committee, consisting of representatives of various organisations and Government departments, to consider :—

1. Whether any extension or amendment of the Merchandise Marks Act is required in respect of the provisions relating to indications of origin.

2. The utility and effect of National Trade "Marks" or other similar (collective) marks, and how far they should be authorised or encouraged in this country.

3. How far further international action may be necessary for the purpose of preventing the false marking of goods.

Mr. Harry Green, M.P., is chairman.

At present imported articles are not required to show the country of origin, unless they already bear marks likely to mislead.

U.S. Electrical Exports.—The *Electrical World* Bulletin Service No. 2, says that the U.S. electrical exports in August were the third largest on record, amounting to $7,716,228. It also states that manufacturers in a number of lines, including some heating devices, fractional horse-power motors and rubber-covered wires are taking no further orders for 1919 shipment. Porcelain prices have advanced, and the new schedule of fan prices which is expected later this month may show prices 10 to 15 per cent. higher.

An Octaval Rule.—We have received from the Watkins Meter Co., of Imperial Mills, Hereford, a sample of their 4-in. octaval rule for engineers, which is based on the principle of binary division ; it is proposed that all readings shall be in eighths and sixty-fourths, so that, for example, 9/16 shall be read as 4/8 + 4/64, which in the Watkins notation is written .44. An attempt is made to employ an octaval system of numeration, from which 9 and 10 are absent ; thus .41 + .06 + .73 adds up to 1.42. In the instruction card it is pointed out that the existing notation is so clumsy that the subdivisions of the inch, such as 33/64, 17/32, &c., cannot be marked on rules, micrometers, or calipers, but it is claimed that in octavals they can be so marked, as .41, .42, &c. On the sample before us, each eighth is numbered, and a few of the thirty-seconds, and the four lines denoting the latter in each one-eighth interval are successively stepped to distinguish them. This marking, which is the subject of a patent application, is a distinct improvement on the present method. We hardly need say, however, that while we welcome any device calculated to lighten the task of the British workman who is compelled to go on using our unpractical system of measuring in vulgar fractions while more enlightened peoples count in tens and tenths, we can only look upon such a device as a palliative, pending the general adoption of the metric system. The Watkins rule is good ; the Watkins system of octaval numeration, involving the use of a new arithmetic, has no earthly chance of adoption, and the suggestion to mark micrometers on that system is a nightmare.

Italian Orders for Germany.—According to the *Ironmonger*, the Deutsche Maschinenfabrik at Duisburg has received an order for the erection of rolling mills in Italy. The electrical installations will be supplied by the Siemens-Schuckert works.

Scrap Material for Disposal.—The Portsmouth Corporation tramways department invites tenders for the purchase of approximately 310 tons of scrap material containing steel car axles, wheels, fish plates, points, rails, &c. See our advertisement pages to-day.

German Aluminium Works.—It is reported that the German Government intends to take into State ownership the large aluminium works established during the war. The State is said to have already aquired all the shares in the Ver. Aluminium Werke A.G., of Hoverswerde.

New Belgian Companies.—A new company has just been formed at Schaerbeek, Brussels, with a capital of £10,000, and the title La Société Generale pour l'Application du Chauffage Central, de l'Electricitè, et d'Appareils Sanitaires.

La Société La Magneto Belge is the name of a new concern which has lately been formed in Brussels, with a capital of £20,000, to manufacture ignition magnetos.

New Swedish Companies.—Among the new companies recently formed in Sweden in connection with electric lighting undertakings in that country are the Ytterhogdals Elektriska Kraft Aktiebolag, of Ytterhogdal, and the Farila Elektriska Kraft Aktiebolag, of Farila.

British Trade-Mark Applications.—Appended is a brief summary of the recent applications for British trade marks in respect of goods connected with the electrical industries :—

Fish-Spine. No. 391,995. Class 16. Electric insulators made of porcelain. Taylor, Tunnicliffe & Co., Ltd., Eastwood Works, West Terrace, Hanley. June 5th, 1919.

Alternacycle. No. 392,502. Class 13. Electric lamps for bicycles and motor cars. Lucien Rosengart, trading as the Etablissements L. Rosengart, 7 and 13, Avenue de Sainte-Mandè, Paris. June 20th, 1919.

Keramot. Nos. 373,295 and 375,573. Class 40. An insulating composition, mainly of india-rubber, for electrical purposes. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, London, W. November 10th, 1916.

Synroz. No. 393,740. Class 50. Electric insulating material. Reginald Percy Chester, Fir Hill, East Downes Road, Bowden, Cheshire. July 29th, 1919.

Lesco. No. 386,666. Class 13. Electric fittings of ordinary metal. Vernon Hope, the Firs, Worley Grove, Macclesfield. February 26th, 1919.

Chalmit. No. 393,684. Class 13. Electric fittings and accessories. Andrew Chalmers and Mitchell, 49-51, William Street, Anderton, Glasgow. August 28th, 1919.

R (letter and design). No. 394,535. All goods in Class 8. Société La Radiotechnique. 65, Rue Trarieux, Lyons, France. August 28th, 1919.

Imp. No. 394,253. Class 6. Magnetos. Imperial Typewriter Co., Ltd., 39, London Street, North Evington, Leicester. August 15th. 1919.

Liberty (lettering and design). No. 391,554. Class 18. Electric welding plant. Ivor Bertram Blaiberg, Regency House, Warwick Street, London, W. May 24th, 1919.

Club Dinner.—The members of the Victoria Works Athletic Club (Johnson & Phillips, Ltd.) held a very successful dinner and concert, on 25th inst., at the Shakespeare Hotel, Woolwich. The company at dinner numbered nearly 170. Mr. H. J. Shepherd (one of the presidents) was in the chair, and was supported by Messrs. W. H. Johns, G. C. Pearson, C. Stewart, and D. A. S. Porteous (vice-presidents). The usual toasts were followed by the concert, the following artists contributing :—Miss Olive Turner, Miss F. L. Knight. Mr. Lawrie Garland, Mr. F. T. Warren, Mr. W. A. Booth, with Miss L. M. Andrews at the piano.

Lantern Slides for Lectures.—Messrs. Ed. Bennis & Co., Ltd., inform us that they have a large number of lantern slides dealing with the development and present practice of automatic stokers, coal elevators and conveyors, &c., which they will be pleased to lend to any responsible engineer for lecture purposes. A list of the slides and particulars of their subject-matter can be obtained on request. Applications for slides should be made as far in advance of the lecture as possible, and should be addressed to 28, Victoria Street, London, S.W. 1.

National Union of Manufacturers (Inc.).—We have received from the General Secretary of this Association (Mr. G. R. Cheesman, 6, Holborn Viaduct, E.C. 1) a copy of its red book, containing a list of members of the Association, revised to July 1st, 1919. We have heard a good deal of "Black" Lists during the war. This one is a "White" List of purely British manufacturing concerns. Members aim at intertrading, as far as possible, with one another.

Trade Announcements.—Mr. H. J. Creffield, electrical engineer, formerly of Vickers, Ltd., announces that he is now in partnership (trading as Osmond & Creffield, electrical engineers) at Faraday Works, Britannia Bridge, Erith.

Following the arrangements recently made whereby the Siddeley-Deasy Motor-Car Co., Ltd., became allied with Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., the title of the company has now been changed, and all communications should in future be addressed to Armstrong-Siddeley Motors, Ltd., whose head office is at Coventry.

Messrs. Napier-Kimber, Ltd., of 109, Great Portland Street, London, W. 1, have been appointed sole agents for the "N.K." Canadian vacuum cleaner.

Pope's Wire Lamp Works.—The report of the directors of the N.V. Pope's Metaaldraad Lampen-Fabriek, of Venlo, which deals with the year ended on June 30th, 1919, states that an active demand was experienced both in Holland and abroad, whilst the advance in prices continued in the first half of the year. Although many difficulties in shipping still prevailed during this period, the company succeeded in delivering its products regularly, and cleared a large portion of the stocks. The action maintained since 1913 against the English Osram Co. concerning the manufacture of squirted filament lamps had been decided against the Dutch company, and the costs, amounting to £7,300, had been paid. This item had been written off partly by utilising the extra reserve fund which had been formed for this purpose during several years, and partly by drawing upon the ordinary reserve fund for about one-half of the amount. After setting aside £4,900 for depreciation, the accounts show net profits of £12,000, which sum permits of the payment of a dividend of 10½ per cent. on the ordinary shares, as compared with 11½ per cent. in 1917-18. The share capital amounts to £83,333.

Book Notices.—*The Electrification of the Metropolitan Railway System of Melbourne.* Edited by C. T. Stephenson. Pp. 64; 85 figs. Melbourne: *Industrial Australian and Mining Standard.* 1919.—This publication, issued as a supplement to the *Industrial Australian and Mining Standard*, describes a work in which great interest has been taken in railway and engineering circles. The electrification of the Victorian railway system has been under discussion for about 23 years, and the Railway Commissioners were active in opposing a premature change. The work of equipping the Melbourne suburban railways for electric service is now complete on some lines, and on the success of the experiment will depend the future direction of railway development throughout the Commonwealth. The publication of this pamphlet, descriptive of the work, is a fitting acknowledgement of this epoch in the history of the system. It begins with an historic account of the events leading up to the adoption of the scheme, followed by general conclusions and the influence of the electrification of the railways upon the supply of electric power in Victoria. Chapters then follow dealing in turn with the Newport power house, distribution system, sub-stations, rolling stock, permanent way, signalling, car workshops, &c. The print is clean, the type large, and a large number of illustrations and diagrams assist to give the reader a clear conception of the whole work of electrification.

We have received a copy of *The Industrial North*, edited by Mr. Robert Donald, and published, on October 24th, by the *Yorkshire Observer*, price 1s. 6d. Printed in clear, bold type, on good paper, and containing articles of interest to all branches of industry, together with numerous advertisements, the issue will doubtless find favour in all parts of the country. In an article entitled "The New Electricity Bill and the Manufacturer," the Editor of the *Electrical Times* points out to the manufacturer that he must not expect a reduction in the cost of electrical energy for five years, and states that it may even be seven years from the present date before the manufacturer will benefit by the Bill which is now under discussion. In an article which deals with the "Conservation of our Coal Supplies," and which in reality is the report of an interview with Sir Arthur Duckham, K.C.B., that authority suggests that Commissioners should be appointed by the State, to investigate the fuel statistics of the various branches of industry, including electrical undertakings; to carry out research work; to detect the presence of waste heat, and to devise the best methods for its distribution and supply. He adds that these Commissioners should be given powers to prevent wanton waste.

"Reid's Handy Colliery Guide for Northumberland, Durham, and Yorkshire." Pp. 252 and map. Newcastle: A. Reid & Co., Ltd. Price 2s. 6d.—This new edition contains the latest official returns, regulations, &c., including the Coal Mines Acts, Electricity Rules and Memorandum, and other relevant matter, lists of colliery owners, agents, managers, and engineers, Associations connected with the coal trade, inspectors of mines, &c.—a very handy book of reference.

The following British Standard Specifications have just been issued:—

British Standard Specification No. 81 *for Instrument Transformers.*—Two classes of current transformers, and one class of potential transformers, are dealt with in this specification. Limits of error for ratio of phase angle are specified, and high-pressure tests, ratios of transformation, and rated outputs, are among the items included in the specification. The standard sizes of current transformers range from 5 to 5,000 amperes with a secondary current of 5 amperes in each case, and the standard sizes of potential transformers range from 110 to 33,000 volts, with a secondary pressure of 110 volts in each case. Appendices dealing with the use of transformers in general, the use of transformers with electricity meters and single-turn current transformers, respectively, are included.

British Standard Specification No. 89, *for Indicating Ammeters, Voltmeters, Wattmeters, Frequency and Power-Factor Meters.*—The British Engineering Standards Association's Report No. 49 for Ammeters and Voltmeters was issued in 1908, and the Sub-Committee responsible for its revision found it necessary greatly to increase its scope, with the result that a new B.S. Specification (No. 89) dealing with indicating ammeters, voltmeters, wattmeters, frequency and power-factor meters has been drawn up. In addition to the requirements with regard to accuracy, the specification includes a number of definitions, clauses relating to types of enclosure, such as flame-proof, water-tight, splash-proof, scales, limiting the number of scales to those more easily read, marking polarity of terminals both for direct-current and polyphase-current instruments, insulation, shunts, &c.

For the purpose of dealing with the question of accuracy, all instruments are divided into three classes, namely, sub-standard, first grade and second grade respectively. Appendices deal with methods of marking scales, the accuracy of which various types of instruments are capable, the method of erecting shunts, and damping.

British Standard Specification No. 90 *for Recording (Graphic) Ammeters, Voltmeters, and Wattmeters.*—This is the first British Standard Specification dealing with recording instruments. In addition to the requirements in respect of accuracy, the specification includes a number of definitions, and clauses relating to chart ruling, insulation, external shunts, and marking polarity of terminals for both direct-current and polyphase-current instruments. Appendices dealing with the accuracy of different types of recorders, chart speed, and shunts respectively are included in the specification.

British Standard Specification No. 107, *for Rolled Sections for Magnet Steel.*—This specification includes a symmetrical series of 60 sections for general purposes, 26 of which it is recommended should not be used unless it is impossible to use any of the remaining 34 sections, and a supplementary list of 10 special sections for ignition magnetos. A table of tolerances on the dimensions of the rolled sections and two plates showing all the sections are included in the specification. All the dimensions are in millimetres.

Each of these reports is issued at the nominal price of 1s. 2d. post free, and can be obtained from the British Engineering Standards Association, 28, Victoria Street, S.W. 1, or Crosby Lockwood and Son.

"Eleventh Annual Report of the Hydro-Electric Power Commission of the Province of Ontario," for the year ended October 31st, 1918. Vols. I, II and III. Toronto: A. T. Wilgress, Government printer.

"The Industrial Council of the Building Industry." Pp. 153. London: The Garton Foundation. Price 1s. net.

"Post Office Electrical Engineers' *Journal*." Vol. XII. Part 3. October, 1919. London: Electrical Review, Ltd. Price 2s. net.

"Science Abstracts" (A and B). Vol. XXII. No. 261, Part 9. September 30th, 1919. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each, net.

We have received reprints of four lectures delivered before the Royal Institution of Great Britain: "Ether and Matter," by Sir Oliver J. Lodge, F.R.S.; "The Hardening of Steel," by Prof. H. C. H. Carpenter, F.R.S.; "The Spinning-Top in Harness," by Sir George Greenhill; and "Atomic Projectiles and their Collisions with Light Atoms," by Prof. Sir Ernest Rutherford, F.R.S.

Lead.—Messrs. James Forster & Co. report, under date October 25th:—

> Business continues daily on an enormous and unprecedented scale, the turnover for the third week in succession again being rather over 8,000 tons. The bulk of the quantity sold has again been for next year, and although much of it is of a speculative nature, a large business has been done with consumers, who have not only bought freely for this year's delivery, but are also anticipating their requirements for January-February next year. There has also been a big demand for export, particularly from France, which, in view of the adverse exchange, indicates considerable scarcity over there.
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> The Government stocks of lead in the London district are now exhausted, and, with the prevailing scarcity of railway trucks, we may have difficulty in obtaining prompt supplies as required. . . .
>
> The highest prices paid were on Thursday, when January changed hands at £31 5s., and February at £31 10s. Yesterday's closing prices were:—October, £30 10s.; November, £30 15s.; December, £30 15s.; January and February, £31. The rise in early load on the week is no less than 22s. 6d. per ton.

Messrs. G. Cawson & Co. report that one leading authority predicts a large increase in production in about four months. With the high price of silver (a large product of lead), there is every inducement to mine owners to increase their output at the present price of lead. "The Government are still out of the market, and are busy arranging deliveries on old contracts; it is quite likely, however, that they may be selling again in a few days to take advantage of the present range of prices. . . . Although the tone at the close is fairly steady, we still recommend caution."

The Moulders' Strike.—Reports from different parts of the country show that the continuance of the moulders' strike is having serious effects upon the engineering industries. In Sheffield, on Tyneside, and elsewhere, many other classes of workers have been thrown out of work in consequence of supplies of castings becoming exhausted. The strike has already lasted for six weeks, and a deadlock is reported.

The Sterling Club.—Full use is being made of the Recreation Hall of the Sterling Athletic and Social Club (Sterling Telephone and Electric Co.), at Dagenham, during meal hours. Dancing, with a concert once a week, takes place. On alternate Wednesday evenings a dance and whist drive is held. Physical culture classes on two nights a week are a new feature, and a dancing class for beginners is held once a week, as is also a practice of the orchestra. On Saturday evenings dances, concerts, &c., follow the football, at which game both teams are doing well. The First XI is undefeated. Last Saturday Associated Equipment were defeated by 6 goals to nil in the London Business Houses Cup, and Grove Green by 3—0 in a friendly.

Non-Ferrous Metal Industry.—The *London Gazette* for October 28th contains a list of further licences granted under this Act.

Copper Prices.—Messrs. F. Smith & Co. report, October 28th, electrolytic bars, £119; decrease, £3; ditto sheets, no change; ditto wire rods, £132; increase, £2; ditto H.C. wire, 1s. 4d.; decrease, ½d.

Messrs. James & Shakespeare report, October 28th, copper bars (best selected), sheets and rods, no change.

Industrial Publicity Service, Ltd.—A petition for confirmation of an alteration and extension of the company's objects, carried at meetings held in July last, is to be heard before Mr. Justice Astbury on Tuesday next.

An Employers' Convention.—On Thursday next there is to be held at the Central Hall, Westminster, S.W., a one day's convention for business men. The morning session will open at 10 a.m., and will consider the following subjects until 12.30 p.m.:—"What we can do ourselves:—(1) Scientific Management; (2) Staff Training; (3) Business Literature; (4) Better Salesmanship and Advertising." The afternoon session, from 3 p.m. to 5.30 p.m., will discuss:—"What the Government can do:—(1) Freedom of Commerce; (2) Prevention of Strikes; (3) Immediate Economy; (4) Equitable Taxation." In the evening there will be a mass meeting. Admission will be by ticket, obtainable from the *Efficiency Magazine*, 4, Lincoln's Inn Fields, London, W.C. 2.

Catalogues and Lists.—The British Insulated and Helsby Cables, Ltd., Prescot, Lancashire.—Illustrated booklet No. H83, giving interesting and useful information about power factor improvement, with a particular bearing on Helsby condensers. Leaflet No. P159 gives description and prices of jointing compounds.

Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street, Westminster, London, S.W. 1.—Fourth edition of their sprinkler stoker catalogue well illustrated and brought up to date.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, London, S.E. 18.—A new illustrated catalogue, giving prices, and dealing with rubber-insulated wires and cables, and containing a leaflet which compares the old standard sizes of conductors given in the Engineering Standards Committee Report of 1910, with the new standard sizes set out in the British standard specification for insulated annealed copper conductors in 1919. The list also contains a page of useful metric and other equivalents. The new standards are used, and prices are quoted per 1000 yards, the standard coils being 100 yards in length.

The India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd., Silvertown, E. 16.—List No. 40 of Association wires and cables, embodying the new standards of the British Engineering Standards Association, and giving the dimensions in millimetres as well as in inches, also weight and resistance per kilometre as well as per mile and per 1,000 yards. Numerous types of cable are listed, single and twin, fittings wires, flexible cords, &c.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, E.C. 2.—Catalogue of wires and cables (Section A) based on the new standards, and divided into a separate section for each class of cable—"Association," "Non-Association" "Solid Rubber Sheathed," and "Flexible Cords." Some special flexible cables and three-core cables are new features, and new types of "Special Thermoid Flexible" have been introduced; the flexible-cord price list also includes motor-car lighting, starter, and ignition flexibles. Further lists will be issued later, on the loose-leaf system.

Messrs. Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, Essex.—Illustrated leaflets Nos. 70 and 76, giving respectively a description of the "popular" dry battery, and the "Kwik-Lok" shade carrier.

The Herbert Frood Co., Ltd., Chapel-en-le-Frith, Derbyshire.—Illustrated booklet No. 537, entitled "A Short Treatise on the Theory and Practice of Plate Clutches." This book gives many useful data relating to clutches in general, and to Ferodo linings for clutches, in particular.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton.—Illustrated leaflets Nos. 123, 124, and 127, dealing with ventilating blowers and fans of various patterns.

London Electric Stores, Fulwood House, High Holborn, London, W.C. 1.—A small illustrated leaflet describing the Silverdale hot plate.

The B.E. Co., Hendon House, 57, Upper Thames Street, London, E.C. 4.—Leaflets Nos. 6 and 7, giving prices of wood blocks and adaptors.

Liquidations and Dissolutions.—Veritys' Founders.—Meeting, November 26th, at Plume Works, Aston, to hear an account of the winding-up from the liquidator, Mr. C. J. Pitt.

Hudson Economiser Co. (1907), Ltd.—Winding up voluntarily. Liquidator, Mr. R. S. Hunton, 110, Bishopsgate Street, E.C. 2.

Dick, Kerr & Co., Ltd.—Winding up voluntarily. Mr. G. R. Freeman, of 66, Coleman Street, E.C., the liquidator, is authorised to accept and sell the undertaking of the company to the English Electric Co., Ltd., on the terms of their offer. Meeting of creditors November 10th, at 66, Coleman Street. Claims must be sent to the liquidator by December 31st.

Harry W. Cox & Co., Ltd.—Meeting of creditors on Nov. 3rd., at 84, Acton Lane, London. Claims must be sent to the liquidator, Mr. B. H. Morphy, by December 23rd.

C. H. Davies & Co., manufacturers of electrical fittings, 153, Bracebridge Street, Birmingham.—Mr. C. H. Davies and Mr. W. H. Arundale have dissolved partnership. Debts will be attended to by Mr. C. H. Davies, who will continue the business under the same style and at the same address.

Hooghwinkel, Anthony Brown and Partners, civil and electrical engineers, 24, Martin's Lane, Cannon Street, E.C.—Mr. G. H. J. Hooghwinkel and Mr. W. A. Brown have dissolved partnership. Communications with regard to debts should be addressed to Anthony Brown & Hooghwinkel, Ltd., 24, Martin's Lane.

Machine Tool and Engineering Association, Ltd.—Meeting December 3rd, at Connaught Rooms, W.C. 2, to hear an account of the winding-up from the liquidator, Mr. H. G. Williams.

Connolly Bros., Ltd., Blackley, Manchester.—First meeting of creditors and contributories, November 13th, at Carey Street, W.C.

LIGHTING AND POWER NOTES.

Aberdeen.—Year's Working.—The annual accounts for the year ended July 31st, 1919, show that the total expenditure was £65,306, compared with £58,502 the previous year, and the total income was £107,996, compared with £102,546 for the previous year; thus leaving a gross profit of £42,690, of which £14,129 was written off as interest on mortgages, loans, &c., while £21,025 was relegated to the sinking fund, and the remaining net revenue of £7,537 was carried to the reserve fund. The value of the sinking fund to date is £215,430, while the reserve fund now stands at £58,086. The total numbers of units generated in 1918 and 1919 respectively were 20,276,880 and 19,815,610, while the total units sold were respectively 17,408.147 and 16,368,054. The quantity unaccounted for was, during 1918 and 1919 respectively, 499,560 and 549,718, or 2·46 and 2·77 per cent. The number of consumers was increased during the year by 161, making a total of 3,821 at the end of the financial year. The total H.P. of motors connected amounts to 18.684, an increase of 1,829 H.P. during the year. The number of heating and cooking utensils hired out has increased by 123, making a total of 1,721. There are now 12 sub-stations in operation. Two new boilers were put in commission in November last. One of the Green economisers has been renewed. The brickwork of Nos. 7 and 8 boilers is being entirely rebuilt. A second 5,000-KW. turbo-alternator was due for delivery early in September, and a new 1,000-KW. converter has been erected in the engine room of Ferry Hill station, making its total converting capacity 4,000 KW. The increased costs, amounting to £6,804, are due to increased price of coal and increases in wages, taxes and materials.

Accrington.—Failure of Supply.—At the busiest hour on Saturday there was a complete failure of the supply. The Electricity Committee held an inquiry into the failure on Monday, and found that it was due primarily to the poor quality of coal available for the generation of steam; it was intimated that steps had been taken to prevent a recurrence of the mishap.

Having regard to recent electrical breakdowns, it is stated that the local cables have been connected with the cables of Rawtenstall.

Aldershot.—Prices.—The B. of T. has authorised the U.D.C. to increase the charge for electricity up to 10d. per unit. for a period of two years after the war.

Annfield Plain (Co. Durham).—Lighting Scheme.—There is a proposal afoot to borrow £17,700 for the purchase of an electric lighting undertaking, to replace gas for public lighting.

Aspatria.—E.L. Scheme.—The U.D.C. has decided to consult a qualified electrical engineer as to the advisability of establishing electricity works in the town.

Athy (Co. Kildare).—E.L. Scheme.—Mr. Sean MacEntee, M.P., Belfast, has been appointed consulting electrical engineer for an electricity scheme. The Bishop of Killaloe has appointed him in a similar capacity for an electric lighting scheme in Ennis, Co. Clare, which is to be carried out at an expenditure of £4,000.

Australia.—Bendigo.—Year's Working.—The receipts from Eaglehawk municipal electric light works during the year amounted to £1,737, and the expenditure to £1,454, leaving a credit balance of £283, which is considered highly satisfactory, as the price charged to consumers is only 7d. per unit, and no extra charge has been levied to meet the higher prices for materials.—*The Age.*

Ballinrobe (Co. Galway).—E.L. Scheme.—The local Committee is perfecting a scheme for the electric lighting of the town.

Bandon.—E.L. Scheme.—The work of installing a public electric lighting system for the town has been entered upon, and will be completed as quickly as possible.

Bierton.—E.L. Scheme.—The P.C., whilst not deciding to adopt the Public Lighting Act has undertaken to canvass the residents, with the view of ascertaining what prospective consumers of electricity will guarantee to take, the object being to obtain a supply of current from Aylesbury.

Bodmin.—E.L. Scheme.—A private company, with a capital of £5,000, is being formed to establish E.L. works in the town. The consulting engineer and manager is Mr. H. E. Hill.

Bryn-mawr.—Prov. Order.—The U.D.C. has decided to join with the Blaina Council in applying for a prov. order for electric lighting.

Burnham-on-Sea.—Street Lighting.—The U.D.C. has accepted the tender of the E.L. Co. for public lighting at £3 10s. per 50-C.P. lamp for six months.

Cardiff.—Street Lighting.—Full lighting in the streets is now resumed, the electric lamps being used "to their utmost capacity" in the business thoroughfares. Business premises and places of amusement have resumed their pre-war display of special frontal illumination.

Docks Estate Supply.—After prolonged discussion the Corporation has been granted powers to enter the Docks Estate to supply, without payment of wayleaves, electrical energy to industrial establishments.

Cavan.—E.L. Scheme.—It has been decided to form a private E.L. and P. Co., with a capital of £4,000, and install an electric lighting system, at an estimated cost of £5,700. The balance required is to be borrowed.

Chesterfield.—Extensions.—The T.C. has approved of a draft agreement to supply electricity to the Chesterfield Tube Co., Ltd., at the pre-war rate, plus the extra charges for materials and wages. The mains are to be extended to supply Whittington.

Ceylon.—Hydro-Electric Scheme.—It is reported that there are 13 sources which, if dammed and tapped, would yield approximately 500,000 H.P. Since the present demand for power is only 60,000 to 70,000 H.P., it is suggested that only the Laxapana and Dickoya rivers be harnessed, as they would supply about 200,000 H.P.

Chobham.—Public Lighting.—After receiving a report from the Committee which had discussed with the representatives of the Woking E.S. Co., Ltd., the question of public lighting by electricity, it has been decided that the cost (£1,000 for lamps and £5 a year for maintenance per lamp), is prohibitive, and the question has been postponed *sine die*.

Cleator Moor.—E.L. Scheme.—The U.D.C. has decided to engage a qualified electrical engineer to advise on the laying-down of electrical plant for public and private lighting.

Continental.—Italy.—Large hydroelectric undertakings are projected in the Province of Ombria in Italy. It is intended to build two large reservoirs, one on the River Salto, at Baize di Santa Lucia, capable of holding 81,000,000 cubic metres of water; and the other on the River Turano, at Petescia, of a capacity of 132,000,000 cubic metres. Besides subsidiary works and installations of local interest, two generating stations will be built, one utilising a waterfall at Collestatte 150 metres high, and another at Cervara, 65 metres high, capable of yielding 106,421 H.P. together. The works are estimated to cost 70,660,000 lire, of which about one-third is intended for the subsidiary works, &c.

France.—The scheme for the electrification of the lines of the Compagnie des Chemins de Fer du Midi embraces the whole of the company's network, save the Bordeaux-Cette section. Up to 1916 the lines converted were those from Lourdes to Pierrefitte, Tarbes to Bagnères, Lannemezan to Arreau-Cadéac, and Perpignan to Villefranche. The lines under conversion in 1914 included all the sections from Pau to Montréjeau. The outbreak of the war stopped the several works, which were nearing completion. The whole of these lines are expected to be ready for traffic by the end of 1921, which is about the time when the company hopes to resume possession of its hydroelectric stations requisitioned by the State. The most noteworthy of these are the Soulom station, near Pierrefitte, and the Eget station to the north of Arreau. The former was one of the first built by the company, and draws its power from falls of 180 to 240 metres in height. It yields an average power of 10,000 H.P., rising to 21,000 H.P. in exceptional periods. The average power of the Eget station is 20,000 H.P., rising exceptionally to 35,000 H.P.

Copenhagen.—The management of the municipal electricity supply works has asked the Town Council to approve an expenditure of £120,000 for the extension of the works and the transformer plant, and £161,000 for the acquisition of a turbo-generator and boilers, for the new works at the Kalvebodstrand. At the same time proposals were submitted for a further extension of the works so as to be ready for the development which is expected after the abolition of the rationing system.

Darwen.—Bulk Supply.—The Corporation has made application to the Lancashire Electric Power Co. for terms for a supply of electricity.

Dublin.—Price Increase.—The E.S. Committee has asked the Council to sanction an application to the B. of T. for permission to increase the price of energy for lighting by ½d. per unit.

Felixstowe.—Diesel Engines.—We are informed by the Diesel Engine Users' Association that the Felixstowe branch of the Suffolk E.S. Co., which uses Diesel engines to generate electricity, has been granted exemption from the provisions of the Household Fuel and Lighting Order, 1919, in the matter of supplies to consumers.

Hindley.—Price Increase.—The U.D.C. has increased the price of electricity by 50 per cent. for lighting and heating from October 1st. For connections a minimum charge of £1 towards the cost of service cable is to be levied, together with an additional sum of 6s. for each yard in excess of two yards required on the premises.

Hull.—Meter Shortage.—It is stated that 300 prospective consumers are waiting for connection, as the Corporation is unable to procure meters for them.

Leeds.—Price Increase.—It has been decided to make a minimum charge of 2s. 6d., plus 60 per cent. (or 4s. in all), for lighting.

Leominster.—E.L. Scheme.—The Parish Council has decided in favour of a scheme for electric lighting. The energy will be obtained from Hereford.

Limerick.—Price Increase.—The charge for electric lighting has been raised by 3d. to 1s. per unit.

London.—Stepney.—It is reported that the annual accounts for the year ended March 31st, 1919, show a total income of £175,834, and an expenditure of £110,154, *i.e.*, an increase of about £25,000 on the income and about £6,000 on the expenditure; £19,012 was paid as interest on loans, £24,999 was written off as repayment of loans, leaving a profit of £22,245. The total capital then employed was £689,528, of which £664,860 had been borrowed from the L.C.C. and others; £18,350 had been provided from revenue, and £5,344 from meters and service lines.

Stoke Newington.—During the war house services for non-war purposes were laid only in cases where the applicants paid the cost thereof. It is now proposed to refund to such consumers the cost of their services, amounting to a total of £515.

An increase of 25 per cent. upon present charges for electricity is to take effect as from the close of the September quarter.

Londonderry.—Lighting Restrictions.—The Corporation has notified electricity consumers that during the winter, between the hours of dusk (or interior lighting time) and 6 p.m. (excepting Saturdays and Sundays), the power demand must be reduced by an amount equivalent to the lighting demand; that window or outside lighting must be abandoned; and that not more than 50 per cent. ordinary lighting is to be permitted in private houses and hotels and by other consumers.

Louth.—Proposed E.L. Scheme.—The Arrota Electric and Accessories Co. intends to float an auxiliary company, to carry out the installation of electrical equipment for lighting, power, and heating, if the canvass of the town gives evidence that there will be enough consumers to warrant the undertaking.

Millbrook.—Loan.—Application has been made to the M. of H. for a loan to finance the new lighting scheme.

Oswaldtwistle.—E.L. Scheme.—The B. of T. will not entertain the application for a prov. order for a new electric supply undertaking, pending the decision of Parliament on the Electricity (Supply) Bill.

Portrush (Co. Antrim).—E.L. Scheme.—The B. of T. has been asked to sanction the electric lighting scheme.

Pembroke (Co. Dublin).—Price Increase.—The U.D.C. has decided to increase the electricity charges from 7½d. to 8d. per unit for lighting, and by ½d. for cooking, heating and power.

Pontefract.—Mains Extensions.—The R.D.C. has decided to raise no objection to the use of overhead mains by the Yorkshire E.P. Co. for transmission of energy from the Castleford boundary to New Fryston.

St. Albans.—Prices.—The Chamber of Commerce has decided to support the protest of the T.C. against the proposed increase in the charges for electricity by the North Metropolitan E.P. Distribution Co., amounting to 100 per cent. on pre-war prices. The protest is to be sent to the B. of T. and the National Chamber of Trade.

Stratford-on-Avon.—Prices.—The T.C. has referred back to the Committee for further consideration a recommendation not to agree to the application of the Electricity Co., Ltd., for permission to increase the charge for electricity for lighting, which is 8d. per unit, but to agree to the charge for power being increased from 3d. to 4½d. per unit, and that all increases granted during the war be allowed to remain in force until March 31st, 1920, when they will be reviewed.

Thirsk.—Street Lighting.—The U.D.C. has accepted the tender of the E.L. Co. for public lighting at 17s. 6d. per lamp for 765 hours, plus 2s. 6d. each for renewals and repairs.

Tuam.—New Scheme.—The electric lighting scheme of this town is nearing completion, and will be in full swing for the winter lighting of the town.

Tullow (Co. Carlow).—E.L. Scheme.—In connection with the scheme for electric lighting, a meeting was held at which Dr. J. Tennant-Byrne, representing the Bureau of American Manufacturers, of Westland Row, Dublin, explained that his engineer, Dr. Paul Herich, would meet the Tullow Electric Lighting Committee to advise on the cheapest and best plan for the lighting of the town by electricity.

Wigan.—New Installation.—The B. of G. has decided to have the E.L. installed at the Billinge Institution at an estimated cost of £3,150.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—After entirely satisfactory trials with a complete electric train on August 26th last, the Railway Commissioners announced that the system would be inaugurated on the Sunday following. Electrification of the line provides for an average speed of 21 miles per hour, as against 16 miles per hour by steam trains, and the journey from St. Kilda to Melbourne will be reduced to nine minutes. A five-minute service will be run during the busy portions of the day, but in the slack times a 12-minute service will be maintained.

The Commissioners are now considering an all-electric service on the Essendon line. In order to complete this, new plant will have to be installed in the Newmarket and Middle-Brighton sub-stations.—*The Age.*

Sydney.—The report says the earnings increased by £245,060, or 12·30 per cent. over the previous year, while the loss of revenue due to the pneumonic influenza epidemic is estimated at £160,000. The working expenses increased by £247,464 over the previous year,

and now amount to 82·71 per cent. of the earnings. Increases in wages meant an additional outlay of £51,454; differences between civil and military pay, £15,899; and increases in cost of coal and other materials, £75,098. A total increased revenue of £95,000 was collected from the increases made in the tramway fares in August, 1917, and in November, 1918.—*Industrial Australian and Mining Standard.*

Birmingham.—PROPOSED FARE INCREASE.—In consequence of concessions to tramway employés, a proposal to revise fares is under consideration.

Bradford.—The Tramways Committee proposes to try the experiment of having someone in attendance at the central termini at the busy times of the day, to provide change for intending passengers, in order to facilitate a quicker loading-up of the cars.

Branston.—LIGHT RAILWAY.—The R.D.C. has approved a scheme for a light railway in Nocton Fen.

Continental.—BELGIUM.—The question of the electrification of the Belgian railway network, which has been under consideration for a number of years, seems to be about to be practically realised. During the war the Belgian Government nominated a Commission to examine this important problem. The advent of the armistice enabled the Commission to continue its labours on the spot. It was, however, superseded by a newer and stronger Commission, to whose deliberations M. Mazen and Mr. Dawson, French and English railway experts, were invited. At the outset, this Commission decided to defer consideration of a comprehensive scheme pending the realisation of some most urgent works, and in particular the electrification of the Brussels to Antwerp line, at the same time choosing a system of electrification most suitable as a basis for future expansion. For the section, 44 kilometres in length, from Brussels to Antwerp, a line of heavy traffic, and touching important localities, it was decided to adopt the direct current, high-tension system at 2,400 volts, transmission apparently underground for most part, but overhead in the stations. The works are to be taken in hand almost immediately, for the invitations for tenders are said to have been issued, and the works, it is affirmed, will be begun at the beginning of the coming year. The cost of the conversion is put at 5,000,000 fr. for the electric works alone, supplementary works needing a further outlay of 10,000,000 fr. —*L'Industrie Electrique.*

The Brussels tramway employés returned to work on October 21st, after being on strike since the 12th. The companies have recognised the men's unions.

FRANCE.—A mass meeting of employés of the Metropolitan Railway, on Monday, passed a resolution to cease work unless their claims for an increase in wages from 12 to 15 francs a day, a better pension scale, and more liberal annual holidays are granted. Omnibus and tramway employés have declared themselves in sympathy with the Metropolitan workers.

Owing to a strike, it is reported, Boulogne is without tramcars and lighting.

ITALY.—It has been decided to electrify the Santà Biella Railway, and the works are expected to be completed in the course of next year. The preliminaries have also been begun for the electrification of the Novara-Varallo line. The electric conversion of the railway lines connecting the ports of Genoa and Alessandria is expected to be completed by 1922. The section Genoa to Roneo has already been converted, and the remaining sections—Roneo-Novi-Tortona-Voghera—have now been taken in hand.

The Società della Tramvia Lucca-Pescia-Monsummano is getting out plans for a new line from Ponte all'Abate to Pracando. The projected electric conversion of the Pisa to Pontedera tramway is to be forthwith realised, the difficulties standing in the way of the undertaking having been overcome.

The electric railway from Terni to Forli which the Società Mediterranea is building (as a subsidiary to the Rome-Florence-Bologna railway) has been completed as far as Umbertide, the halt before Forli, thus linking up Todi and Perugia, and will be shortly working. The power will be drawn from the Nera Montaro station near Terni on the Nera river. The section between Umbertide and Forli will cross part of the territory of Umbria, Tuscany, and the Romagna, and is to be the subject of a conference called by the Syndic of Perugia, with the object of providing a direct link between Ancona and Leghorn by means of the projected Gualdo-Tadino-Ponte S. Giovanni-Perugia-Chiusi-Siena railway. Should the latter be omitted from the Government's next building programme, Perugia will probably build an electric tramway link with Chiusi, to serve its own particular interests.—*L'Elettricista.*

Considerable significance in connection with the Italian Government's scheme of electrification of Italian railways is attached to the formation of the Società Elettrica Interregionale at Milan. This company has been launched with a subscribed capital of 2,000,000 lire, which will shortly be increased tenfold. Its programme is declared to be the production, purchase and sale of electric energy, and particularly its distribution to working electric undertakings, and the supply of electrical energy for railway, tramway, and river traction. It may also work, for itself or third parties, the electrical parts of the undertakings in question. Its capital is stated to have been wholly found by six of the largest Italian electrical companies, viz., the Elettrica Negri (Genoa), the Idroelettrica Cisalpina (Milan), the Ligure Toscana di Elettricità (Leghorn), the Dinamo, the Società Anonima Imprese Elettriche Conti, and the Edison (Milan). This company is the first of its kind created in response to the Government's wish, when framing its railway electrification plans, that private electric companies should assist in the realisation of its programme. According to *l'Elettrotecnica*, the new company contemplates constructing a long H.T. transmission line, which, linking important Alpine generating stations with others in the Apennines, will end at Leghorn, with a branch towards Liguria, and transverse lines running from North to Middle Italy. Thanks to this line, compensation will be afforded for the relative barrenness of the two districts; but, given the diverse powers of the undertakings in the north and middle of Italy, it will only be by joining up with the future great coal mining schemes foreseen for Tuscany, that the Government's programme can be completely achieved.

SPAIN.—The first section of the Central Metropolitan Railway of Madrid, which has been under construction for three years, was opened to the public recently as announced in our last issue. The concession obtained by the company is for four lines, totalling about 14 km. (9 miles), the completed north-south section being about 4 km. in length. There is a good tramway system in the city owned and operated by the Societé Générale de Tramways Electriques en Espagne, with its headquarters at Brussels, but the services run are held to be insufficient to meet the requirements. The railway scheme is based on that of the Métropolitain Railway at Paris. The tunnels are of concrete, and double tracks are laid throughout. The station platforms are 60 m. (197 ft.) long, and are constructed as nearly as possible to street level. The maximum gradient of the lines, which follow the routes of the streets as nearly as possible, is 4 per cent., and the minimum radius of any curve is 100 m. (328 ft.). The rails, sleepers, chairs, car bodies, machines, and materials for the shops at Cuatro Caminos are of Spanish production; copper bonds, cables, car motors, and trucks, and electrical accessories are from the U.S.A. The estimated cost of the Norte-Sur line was 8 million pesetas (£300,000), of which 979,231 pesetas was for the superstructure and 1,640,000 for the rolling stock. The actual cost is probably in excess of this. A company supplies D.C. in bulk to the railway concern. It was estimated that for 650 cars daily in each direction, or 1,896,000 car km. per annum, the energy consumption would be below 35 watt-hours per ton-km. Assuming an average loaded weight of 34 tons per car, the annual consumption would be 1,594,320 KW.-hours, which at 0.08 peseta would equal 127,545 pesetas per annum. The Madrid Tramway Co. generates power at 0.06 peseta per KW.-hour.—*The Times Engineering Supplement.*

London.—ST. PANCRAS.—Lieut.-Col. J. W. Pringle, B. of T. Inspector, has presented his report on the accident at St. Pancras on August 16th last, when a tramway car overturned, two persons being killed and 20 injured. The conclusions arrived at by the Inspector are:—

That there is evidence to show that the hand and magnetic brakes were in working order, if they had been properly used, when the accident took place. That the speed developed on the journey towards the compulsory stopping place was higher than that authorised, *i.e.*, 16 miles an hour. That the magnetic brake was, in all probability, not utilised early enough to check the speed of the car and bring it to a standstill at the required point. That, eventually at least, owing to mismanagement, by an over forcible use of the hand brake in conjunction with the magnetic brake, locking of the wheels resulted, which caused derailment on the sharpest part of the curve, and the subsequent overturning. It is possible that, if the wheels had not been locked, the car might have kept the rails. The accident illustrates the danger, especially with worn and shallow flanges, which are nowadays inevitable from travelling over much worn rails, that is likely to arise from speeds higher than those authorised, if over hasty and forcible applications of the hand and magnetic brakes are made. The attention of motormen should be called to this point, and to the necessity for observing speed restrictions. In respect of the compulsory stopping place in Great College Street, the place assigned for the car to come to rest is in front of the actual post, *i.e.*, on the curve. The reason for permitting cars to pass the post before coming to a standstill, to give the motorman a better view of traffic in Crowndale Road, is not an adequate reason. The dead stop should be made before the curve commences, and the present practice should be altered accordingly. The superelevation on the curve in question is not enough to justify a speed of 8 M.P.H., and 4 M.P.H. should be substituted.

L.C.C.—The L.C.C. Highways Committee is of opinion that the services rendered during the recent railway strike by motormen, conductors, and certain other tramway employés should receive special recognition, and has decided to grant a period not exceeding two days' leave, with pay. The cost of the proposal would be approximately £9,000.

It is proposed to obtain for Greenwich power station a spare alternator and rotor, which can be installed on the bed-plate of either of the three existing sets in the event of a breakdown, at a cost of £22,500.

The scheme for extending the tramways, at a cost of £8,000,000, which was put before the Council on Wednesday by the Highways Committee, will be considered next week.

Application is to be made to Parliament in session 1920 for the removal of limitations in respect of the use of the tramways in Tooley Street between Bermondsey Street and Joiner Street.

Traffic Control.—In the House of Commons on Wednesday, last week, Sir Eric Geddes announced that the report of the Select Committee on London traffic had been considered by the Cabinet, and it had been decided that all questions of traffic in the London area would be dealt with by the Ministry of Transport, and an Advisory Committee on the lines of the recommendations of the Select Committee would be appointed to advise and assist the Minister. This Committee would include representatives of the Ministry of Transport, Board of Trade, Home Office, Ministry of Health, and the London County Council, probably with an independent chairman.

Accidents.—An omnibus and a L.U.T. tramcar collided at Acton on Thursday morning last week. The tops of both vehicles were badly damaged, and a conductor was hurt.

Traffic on the Piccadilly tube railway was held up for half-an-hour on Thursday last week, owing to a man falling under a train.

At the rush hour on Tuesday morning, last week, a coach, owing to a broken axle, became derailed at Earl's Court, on the Piccadilly tube, causing a complete stoppage.

In Brentford, at a point where the tramway lines are being relaid, a steam wagon on Saturday last collided with a L.U.T. tramway car. The latter was knocked off the rails into the excavated roadway, and was damaged, but remained upright.

Underground Railway.—The Associated London Underground Electric Railway Companies have sent several of their chief officials to the United States to investigate the latest methods of electric traction in use there.

Newcastle-upon-Tyne. — Proposed Tramway Extensions.—An important scheme of tramway extension is embraced in the report of the Parliamentary Committee of the Corporation with respect to the proposed Bill to be introduced in the ensuing session of Parliament. Ten new tramways are proposed, two new tramroads, and ten new omnibus routes. Some of the new tramways are local connections between existing tramways, intended to provide alternative routes, and to ease traffic upon several main thoroughfares, but other proposed extensions will, if adopted, open out several neighbouring areas. Other powers sought in the Bill are powers to run omnibuses outside the city area. It is proposed that powers of acquisition of the Tyneside Tramways and Tramroads Co. should be sought; it is no part of the proposal to derogate from the rights of purchase of the local authorities whose areas are traversed by the Tyneside T. and T. Co., though it may be necessary to ask Parliament to extend to 42 years the period specified, at the expiration of which the local authorities can exercise their powers of acquisition. It is proposed to seek power to enable the Corporation to enter into, and to carry into effect, agreements with any company, or person, to supply electrical energy for power purposes from the Corporation tramway mains where there are no other existing and available mains, and, after notice to the electrical undertakers (if any) in the district, to afford the latter an opportunity of themselves effecting the supply on terms equally favourable to the purchaser. It is further proposed to take power to light, or to supply electrical energy for lighting, all routes traversed by Corporation tramways, whether within or without the city boundary, and for that purpose to enter into agreements with the public lighting authorities for the several areas traversed.

Nottingham.—Accident.—Two women were injured on Saturday in jumping from a running tramcar. A heavily-laden car ran backwards a considerable distance before its progress was arrested.

Portsmouth.—Proposed Fare Increase.—In consequence of the recent award of the Court of Arbitration, granting tramway employés a wages increase, it is proposed to increase the fares, which have not been raised during the war, by 50 per cent.

Rhondda.—Strike.—The strike of tramwaymen has been settled by the local company agreeing to reinstate a driver who was dismissed for running his car before schedule time.

Salford.—Fares.—It is announced that there will be no increase in fares until early in the new year, when the position will be reviewed.

Omnibus Scheme.—At a meeting of the Parliamentary Trust Committee on October 21st, it was decided to promote a Bill in Parliament to secure powers, *inter alia*, to run motor-omnibuses to relieve the tramway congestion and to afford better travelling facilities to and from outlying parts of the borough.

Southend-on-Sea.—Loan.—The T.C. is to apply to the B. of T. for a loan of £31,500 for a new car shed and light-railway extensions. The T.C. has also decided to supply energy for driving pumps at the Thorpe Bay pumping station, at a cost of £305.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Following discussion in the Australian Press relative to the possibility of manufacturing telephone instruments and apparatus in that country, between the general secretary of the Postal Electricians' Union and the P.M.G., the latter dismissed the matter by stating that it was quite possible to manufacture all instruments and equipment in the Commonwealth, but that at the present time it was much cheaper to buy in the open market.

Automatic Telephones.—The largest automatic telephone installation so far installed in Ireland has just been completed at the works of Messrs. James Mackie & Sons, Ltd., Albert Foundry, Belfast, by the Belfast branch of the Automatic Telephone Manufacturing Co., Ltd., Liverpool, for inter-departmental communication. The equipment is designed to accommodate a hundred lines, and is exactly the same in construction as the large automatic exchanges recently installed for the British Post Office in several large towns in England. The exchange mechanism is contained in a cabinet, and at Messrs. Mackie's each telephone has a number of two digits, so that the dial has to be turned twice for each number required.

Belgium.—It is announced that the telephone service between London and Brussels was reopened on the 27th inst., the charge for three minutes' conversation being 8s.

Cable Beacon.—Removed during the war, the telegraph cable beacon indicating the position of the cable to Germany has been re-erected on the beach at Mundesley, Norfolk.

Cable Delays.—The President of the Manchester Chamber of Commerce, last week, addressed a letter to the P.M.G., referring to telegraphic delays to and from Egypt, China, and the Far East generally, in which he says that reports are reaching him which indicate that the general improvement in the service foreshadowed by the P.M.G. is not actually taking place.

China.—American contractors have secured the right to install a long-distance telephone connecting Shanghai with Pekin.

France.—Telegrams from France to England at Press rates will now be accepted only between the hours of 6 p.m. and 9 a.m.

Telephonic communication between France, Great Britain, Luxembourg, the Sarre district and Spain, was resumed, without restriction, at midnight on Monday, after an interval of five years and three months.

Secret Wireless.—The police have opened an inquiry into the secret wireless communications which, it is asserted, are passing between Copenhagen and Petrograd. The Bolsheviks in Petrograd send daily many wireless messages to Copenhagen. The wireless station at the Copenhagen arsenal detected the conspiracy.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen.—November 27th. Great North of Scotland Railway Co. Six or 12 months' supply of telegraph material. Stores Superintendent, 80, Guild Street, Aberdeen.

Australia. — Sydney.—December 19th. Metropolitan Board of Water Supply & Sewerage. Centrifugal pumps, electric motors, &c., for the low-level pumping station, Marrickville. Offices of the Board, 341, Pitt Street, Sydney.*

City Council. The Electricity Committee has decided to obtain quotations in England for two 2,000-kw. converters for the Castlereagh Street sub-station.

January 5th. Electric Lighting Department. Outdoor H.T. switchgear (specification 566); air-brake switches (specification 565). Electric Lighting Department, Town Hall.—*Tenders.*

January 19th, 1920. Sub-station equipment (except power transformers). Contract No. 558.*

Melbourne. — P.M.G.'s Department. January 20th, 1920. Automatic telephone switchboard at Collingwood. Schedule 1,583. (September 19th.)

December 3rd. Victorian Railways. Portable electric welding set and accessories. Secretary for Railways, Spencer Street, Melbourne.*

Belgium.—December 19th. The Permanent Deputation of Limburg. For the concession for the distribution of electrical energy for lighting and power purposes in Limburg. The specifications and plans may be consulted up to December 1st at the offices of Prof. Gillon, 99, Rue des Flamands, Louvain.

Bolton.—November 11th. Electricity Committee. One 8,000-kw. turbo-alternator, with condensing plant, four water-tube boilers. (October 17th).

Bradford.—November 15th. Tramways Department. General stores. Mr. R. H. Wilkinson, Tramways General Manager, 7, Hall Ings.

Dublin.—November 11th. Great Northern Railway Co. (Ireland). 12 months' supply of electric fittings, cable, wire and carbons, &c. (See October 24th.)

Egypt. — Alexandria. —November 15th. Egyptian Postal Administration. General stores for 12 months, including several electrical items.*

Enniskillen.—December 1st. Sligo Leitrim & Northern Counties Railway Co. 12 months' supply of electric telegraph material. The Secretary, Enniskillen.

Kettering.—November 13th. U.D.C. Electricity Department. Cooling tower and foundations. (See this issue.)

Leeds.—November 13th. City Council. Single-phase, 2,000 and 6,600 volts, and Scott-connected transformers, 14,000 K.V.A. capacity; also transformers required during a period of two years. (October 24th.)

London.—Hampstead.—November 3rd. B.C. Tenders from November 20th, 1919, to March 31st, 1920, for oils for the electricity station, and removal of ashes, clinker and boiler refuse. (October 24th.)

Great Western Railway. November 10th. One year's supply of stores, including telegraph instruments and apparatus, electric wires and cables, &c. (See this issue.)

Manchester.—November 11th. Tramways Committee. Special track work. Mr. J. M. McElroy, General Manager.

Prestwich.—November 7th. U.D.C. Electric lighting at Town Hall, Bent Hill. Mr. S. H. Morgan, engineer, Council Offices.

Portumna (Galway).—November 10th. Electric Supply Co. One 50-H.P. gas engine and suction plant; one 30-KW., D.C. generator and motor-booster; storage battery, switchboard, line material, &c. (See this issue.)

New Malden (Surrey).—November 11th. The Maldens and Coombe U.D.C. Two 15-B.H.P. electric motors, and two 4-in. centrifugal pumps, at Kingston Vale pumping station. (See this issue.)

Rhondda.—November 5th. U.D.C. Electricity Department. Two sets of sub-station switchgear. (October 17th.)

South Africa.—Johannesburg.—December 1st. Municipal Council. One 500-KW. converter, and alternatively, one 750-KW. converter, for one of the suburban tramway sub-stations. Specification No. 114.*

January 8th. Municipal Council. Copper wire, cable insulators and steel poles (Contract No. 548). Specification from Town Clerk, Municipal Offices, Johannesburg.—*B. of T. Journal.*

Tunbridge Wells.—Electricity Department. One 750 to 1,000-KW. turbo-alternator, surface condenser and pumps, wet-air filters, piping, economiser, induced-draught fan and engine, and extensions to switchboard, &c. (October 24th.)

Wakefield.—November 8th. Electricity Department. Coke for the Corporation electricity works, Calder Vale, for a year. City Electrical Engineer, Old Town Hall.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

CLOSED.

Australia.—Sydney.—Municipal City Council. Accepted: Switchgear for the power house, £138,491.—Standard Waygood Hercules, Ltd.

Edinburgh.—The Electric Lighting Committee, after consideration of the 16 tenders received for turbo-alternators for the new power station at Portobello, has decided to accept the tender of Messrs. Brown, Boveri & Co., at £106,618, this being the lowest. The three lowest tenders submitted were from Swiss firms. Sir Alexander Kennedy stated in his report that if the Committee wished to consider a tender from a foreign firm he had every confidence in recommending, on technical grounds, that the tender of Messrs. Brown, Boveri & Co. be accepted. If, on the other hand, the Committee desired to put aside the tenders from foreign firms, he would recommend that the tender of Messrs. C. A. Parsons and Co., Ltd., at £174,075, should be accepted. A letter was submitted from the Assistant Secretary of the Board of Trade suggesting "the desirability of stipulating, so far as practicable in all contracts placed, that the goods to be supplied shall be of United Kingdom manufacture." In view of the terms of the letter, a list of the tenders received was supplied to the Board of Trade, and Sir Alexander Kennedy and the Town Clerk had a meeting with the Assistant Secretary of the Board on the subject. The Assistant Secretary stated at this meeting that the circular sent out by the Board did not contemplate any such enormous differences between foreign and British tenders as existed in this particular case, and that the Board could not insist upon the Corporation accepting a British tender in view of such figures, unless it felt it proper to do so on general grounds. Messrs. Brown, Boveri & Co. said that their tender was based on a rate of exchange amounting to 24 f. for a pound sterling. They stipulated that should there be any variation in this rate of exchange their tender price should be modified proportionately. They also stipulated that, in the event of import duties being imposed by this country in connection with machinery or apparatus of the class included in the contract, the amount of such duties should be paid by the Corporation as an extra to the contract.

A *Daily Express* representative interviewed Mr. Watlington, of Messrs. Dick, Kerr & Co., Ltd., with regard to the matter. Mr. Watlington stated that the explanation could be summed up in two words: economic conditions. Over here, in addition to the burden of taxation, we had enormous increases in wages, in the cost of raw material, and in standing charges. There was also a marked decrease in output, as well as a general desire to work shorter hours.

According to Press reports, at the Council meeting held on Tuesday the Convener of the Committee said that the foreign offer involved a saving of £70,000, and they could not pay a premium of this amount for a machine of British manufacture. The Board of Trade had established the fact that the British competitors were unable to reduce their estimates. Sir C. Parsons, one of the competitors, had stated that even without any profit, he could not look at the foreign offer, and he intended to post particulars of the contract where his workmen could read them in his works.

The Council adopted the recommendation to accept the tender of Messrs. Brown, Boveri & Co.

Government Contracts.—The following contracts were placed during September, 1919:—

India Office: Store Department.

Alternator.—Siemens Bros. Dynamos Works.
Apparatus.—Marconi's Wireless Telegraph Co., Ltd.
Balancers, &c.—Bruce Peebles & Co.
Control board.—British Westinghouse E. & M. Co., Ltd.
Cable.—F. Smith & Co., Ltd., Callender's Cable and Construction Co., Ltd.
Condensers.—Automatic Telegraph Manufacturing Co., Ltd.
Copper wire.—Elliotts Metal Co., Ltd.
Copper tubes.—Muntz Metal Co., Ltd.
Cooling tower.—Worthington-Simpson, Ltd.
Generators.—English Electric Co., Ltd.
Generating set.—Lancashire Dynamo, &c., Co., Ltd.
Receivers.—Elliott Bros., Ltd.
Switchboards.—Crompton & Co., Ltd.
Switchgear.—British Thomson-Houston Co., Ltd.
Telephones.—Peel-Conner Telephone Manufacturing Co., Ltd.
Telephone extension.—Automatic Telegraph Manufacturing Co., Ltd.
Transformers.—British Westinghouse E. & M. Co., Ltd.
Trucks.—Leeds Forge Co., British Electric Vehicles, Ltd.
Tubes.—Stewarts & Lloyds, Ltd., British Thomson-Houston, Co., Ltd.
Wire.—Shropshire Iron Co., Whitecross Co., Rylands Bros.

Post Office.

Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Battery boxes.—British L.M. Ericsson Manufacturing Co., Ltd.
Cable brackets.—Bullers, Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Connolly's (Blackley), Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Telephone cords.—Peel-Conner Telephone Works, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Ducts.—Sutton & Co.; J. Woodward, Ltd.; T. Wragg & Sons, Ltd.
Insulators.—Bullers, Ltd.
Lamps for telephones.—General Electric Co., Ltd.
Distribution cable plugs.—Siemens Bros. & Co., Ltd.
Steel poles.—F. Morton & Co., Ltd.
Pulley weights.—Phœnix Telephone & Electrical Works, Ltd.
Solder.—British Insulated & Helsby Cables, Ltd.
Insulator spikes.—T. Parish & Son.
Insulator spindles.—T. & W. Lench, Ltd.
Stay swivels.—Bullers, Ltd.
Telephones.—Phœnix Telephone & Electrical Works.
Bronze wire.—T. Bolton & Sons; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electrical Wire Co. and Smith's, Ltd.).
Flame-proof wire.—Macintosh Cable Co., Ltd.
V.I.R. wire.—H. W. Smith & Co., Ltd.
Laying conduits (short lengths continuous).—Birmingham and district: J. F. Hodge & Co.
Laying ducts.—Gateshead (Durham Road): J. A. Ewart, Ltd.
Laying ducts and pipes.—Yoker: G. P. Trentham, Ltd.
Laying pipes and troughing.—King's Road, Chelsea: J. Mowlem & Co., Ltd.
Telephone Exchange equipment.—Milnsbridge: Siemens Bros. & Co., Ltd.
Telephone Exchange equipment extension.—Victoria, S.W.1: Peel-Conner Telephone Works.
Wireless installations.—Abu Zabal (Cairo), Egypt, wireless station; Leafield (Oxfordshire) wireless station: C. F. Elwell.

Crown Agents for the Colonies.

Line material, insulators, &c.—Bullers, Ltd.
Iron tubular telegraph poles.—Siemens Bros. & Co., Ltd.
Copper line wire.—Shropshire Iron Co., Ltd.

Public Works (Ireland)

Belfast district, electrical works and supplies: A. Stevenson.

Salford.—Tramways Committee. British steel pinion wheels and gear wheels, £595. British Hele-Shaw Patent Clutch Co., Ltd.

Southend-on-Sea.—T.C.:—
Six tramcars.—The Brush Electrical Engineering Co., Ltd.

Primary Power in Argentina.—The results of the census of industries of the Argentine Republic, taken June 1st, 1914, have recently been issued as Vol. VII of the Third National Census. A chapter is devoted to motive power, and the accompanying table, compiled from statistics given in the *Electrical World*, indicates the distribution in prime movers. The total number of undertakings furnishing electricity is 305, with a capital of $290,353,114:—

Industry.	Steam. Units.	Steam. H.P.	Electricity. Units.	Electricity. H.P.	Internal-combustion. Units.	Internal-combustion. H.P.
Foods... ...	1,952	106,648	3,420	34,865	1,888	18,869
Building materials ...	767	29,729	1,453	10,949	520	3,369
Metallurgy ...	195	6,250	1,301	8,165	411	3,151
Chemical products ...	89	2,252	240	2,251	25	348
Printing ...	20	244	727	2,498	37	316
Textiles ...	65	4,980	279	3,475	28	1,633
Electric power	569	352,848	—	—	202	25,227
Other industries	1,168	15,094	2,592	22,586	374	3,399
Total ...	4,058	518,054	10,013	84,790	3,565	56,312

FORTHCOMING EVENTS.

Society of Technical Engineers (Birmingham Branch).—Friday, October 31st. At the Chamber of Commerce, New Street, Birmingham. At 7 p.m. Lecture on "The Problem of Transport," by Prof. F. W. Burstall, M.Sc., &c.

Junior Institution of Engineers.—Friday, October 31st. At 39, Victoria Street, S.W. At 7.30 p.m. Social evening.

Electrical Power Engineers' Association (Derby and District Section).—Saturday, November 1st. At 3.30 p.m. At the Grand Hotel, Leicester. Open general meeting.

Friday, November 7th. At 7.30 p.m. At King's Café, Derby. Supper and social.

Chief Technical Assistants' Association.—Saturday, November 1st. At Anderton's Hotel, Fleet Street, E.C. At 3 p.m. Paper on "The Problem of the Heating and Cooking Load," by Mr. Fells.

Royal Institution of Great Britain.—Monday, November 3rd. At 5 p.m. At Albemarle Street, W. General meeting.

Institution of Civil Engineers.—Tuesday, November 4th. At Gt. George Street, S.W. At 5.30 p.m. Inaugural address by the President, Sir John Purser-Griffith.

Liverpool Engineering Society.—Wednesday, November 5th. At the Royal Institution, Colquitt Street. At 8 p.m. Inaugural address by the President, Mr. J. H. Gibson, O.B.E.

Institution of Electrical Engineers (South-Midland Centre).—Wednesday, November 5th. At the Grand Hotel, Birmingham. Re-union dinner. Reception 6.30. Dinner 7 p.m.

"Dynamicables."—Wednesday, November 5th. At 6.45 p.m. Dinner at the Trocadero Restaurant.

Chemical Society.—Thursday, November 6th. At Burlington House, Piccadilly, W., at 8 p.m. Ordinary scientific meeting.

Technical Inspection Association.—Friday, November 7th. At the Royal Society of Arts, John Street, Adelphi. At 7.30 p.m. Paper on "The Spectroscope in the Science of To-day," by Prof. Baly, F.R.S.

NOTES.

Church Struck by Lightning.—During the storm on October 27th, St. Margaret's Church at Ormesby, near Yarmouth, was struck by lightning. Stones and other material from the tower were brought down with the vane and flagstaff, and the leaden roof was pierced. In the vestry stonework was displaced and surplices were scorched. The ropes in the belfry were destroyed and a wheel was displaced, but the bells escaped injury. Thunder and lightning were accompanied by a heavy fall of hail.—*The Times.*

End of the War in France.—A French official decree has been promulgated, fixing October 24th as the date for the cessation of hostilities. This has a bearing on various important interests.

Bradford Electricians' Wages.—The local branch of the Electrical Contractors' Association has informed the employés, who applied for an increase amounting to over £2 above pre-war rates, that it considers this a national matter, and cannot deal with it locally.

Institution and Lecture Notes.—Electrical Power Engineers' Association (Derby and District Section).—An open general meeting will be held to-morrow afternoon at 3.30 p.m., at the Grand Hotel, Leicester, when important matters will be discussed. Electrical men connected with private plant and the mining industry are invited to attend.

Institution of Electrical Engineers.—The opening meeting of the session 1919-20 will take place at the Institution of Civil Engineers, Great George Street, Westminster, S.W., on Thursday, November 13th, at 6 p.m., when the President, Mr. Roger T. Smith, will deliver his inaugural address. As in the past, light refreshments will be served at 5.30 p.m.

Association of Mining Electrical Engineers.—At the annual meeting, held at Edinburgh on October 25th, office bearers were elected as follows:—President, Mr. C. A. Caslow, Levan, Fife; vice-presidents, Dr. W. M. Thornton, Newcastle, and Mr. C. F. Alexander, Nuneaton; treasurer, Mr. A. Anderson, Wishaw. The luncheon was attended by a distinguished company, including Sir John Cadham, Principal Laurie, and Mr. W. E. Hird, chairman of the Local Centre of the I.E.E. The first gold medal awarded by the Association was presented to the most successful student of the year, Mr. Gray, South Wales.

The West of Scotland branch of the Association resumed the winter session meetings in the Royal Technical College, Glasgow, on October 18th. Mr. Frank Anslow, the new president, in the course of an address, said that it was more difficult to obtain plant for collieries than for any other purpose, a fact which was not without influence upon the small output obtained at present. An examination of a number of collieries on behalf of the authorities revealed what had long been known to many of the members, that the existing steam-raising plants were extremely wasteful. While admitting that it might be to the well-being of the country as a whole to have a Government-controlled and standardised supply of electricity, he thought it would be a mistake to ignore the factors which might have an adverse effect on the supply of power at collieries. The modernisation of our colliery plants electrically to suit the power available would test to the utmost the ingenuity of all concerned.

Belfast Association of Engineers.—Last night Mr. A. Brown delivered his presidential address. The following items are included in the programme of the session:—

November 20th.—"Fuels," by Prof. H. Wren.
December 18th.—"Wireless Communications in the War," by Major R. Stanley.
January 15th, 1920.—"Ship Riveting," by Mr. A. J. Lewis.
February 19th.—"The Ultimate Constitution of Matter," by Mr. W. C. Ward.
March 18th.—"Development of the Belfast Harbour," by Mr. T. S. Gilbert.
April 8th.—Annual general meeting.

SOUND-RANGING.—Before the MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY on October 21st, Prof. W. L. Bragg read a paper on "Sound-Ranging." A sound, said Prof. Bragg, spread from the point where it originated as a spherical cone moving with constant velocity. If it was intercepted by three or more stations whose positions were accurately known, and if the time intervals elapsing between its arrival at the stations were measured, a simple construction would give the position of the source of the sound. The French made experiments with sound-ranging in October, 1914, and showed that it was feasible, and the British Army was encouraged by their success to send an experimental sound-ranging section to the front. This section started operations in October, 1915. The original section became a training school for officers and men. Each section had six microphones spaced along a base opposite the German front line. The microphones were connected to a chronographic instrument at a central headquarters, and when the sound reached each microphone it sent an electric signal recorded by the instrument. In front of the base there were two observation posts so placed that the sound reached them a few seconds before it reached the microphones. This gave time for an observer at the post to press a key which started the recording apparatus at headquarters. By studying the record the time intervals could be measured and the position of the gun plotted on the map. There were between 30 and 40 sections along the front. They could locate batteries between 10,000 and 15,000 yards away with a mean error of about 50 yards. Each section sent in about 1,000 results in the year. The greatest difficulty was caused by adverse winds.

PRIVATE ELECTRIC PLANT.—At the opening meeting of the winter session of the BIRMINGHAM AND DISTRICT ELECTRIC CLUB recently, reference was made in a paper, by Messrs. C. M. Walter and R. G. Marsh, on private electric plant to the growing tendency among suburban householders to install small electric plant. They were thus becoming more and more independent of municipal supplies.

ELECTRICITY IN AGRICULTURE.—Dr. W. E. Sumpner, Principal of the Birmingham Municipal Technical School, lectured on "The Generation and Application of Electricity to Agriculture and Industry," on the 15th inst., at the University of Birmingham, under the auspices of the University and Workers' Educational Association. He pointed out that there was a commercial company near Gloucester which was engaged in utilising devices for the production of H.T. electrical discharges for the intensive production of crops. There were two possibilities in the application of electricity to agriculture; one was to transmit power considerable distances, so that it could be used for agricultural machinery; but the other method, if it were done on a large scale, was more important, as it meant the improvement of crops. Success appeared to have been attained by means of electrical discharges over fields in which crops were growing; increases of from 30 to 40 per cent. had been obtained. Discussing the application of electricity to industry, Dr. Sumpner urged that the use of electricity meant economy; it was an ideal adjustment of the gearing between the engine and its work; the general characteristic was that the old industry was not displaced, but was increased, and electricity developed at the same time. He emphasised the importance of electric power which could do its work at a distance. Mr. R. A. Chattock (electrical engineer, Birmingham Corporation electricity supply department) presided.

WIRELESS DEVELOPMENT.—The development of wireless telephony and the importance of the research work carried on in this connection at the University of London were dealt with by Prof. J. A. Fleming in a lecture delivered at University College, on October 22nd. He described in detail the thermionic oscillator, the first form of which he had himself invented, and the three-electrode valves now chiefly used. The great point about the wireless telephone was the absence of the distortion found in the ordinary telephone—the sound was sharp and short. The wireless telephone was particularly suitable for work in connection with airships and aeroplanes, and it had now been adopted as the regular means of communication on the London-Paris aeroplane service. In a recent flight, perfect speech had been maintained with Kenley until communication was picked up with France. Radio-telephonic speech could now be maintained from an aeroplane with stations on land 150 miles away, and miniature telephone exchanges could be established on aeroplanes so that they could speak to each other as well as to land stations.

The lecturer described an experiment which had been tried in March in order to ascertain with how little power speech could be transmitted across the Atlantic, as a regular thing. The experiment, which was conducted by engineers of the Marconi Co., was between Ballybunnion (County Kerry) and Cape Breton, Nova Scotia. They only transmitted one way. The object was not at all on the same lines as that carried on in the United States in 1915, when by the use of a tremendous battery, communication was established between Arlington (Virginia) and Paris.

The experiment, which lasted 10 or 12 days, was carried on during the day time, not at night, when exceptionally favourable conditions for long-service work occurred. The hours selected were 10 o'clock in the morning to 1 o'clock, during which it might be expected people would want to speak. A pair of generating three-electrode valves were employed, with a third valve for modulating the current to speech form. The power was supplied from a 3½-H.P. alternator, which supplied current at 12,000 volts to the oscillator valves. The aerial wave current was 16 amperes and the wave length 12,000 ft. The receiver was a set of valves in cascade. At a distance of 1,800 miles the speech was quite good enough to be well understood, though for regular work, to overcome interference from more powerful stations, more power would have to be employed. It was now possible also to detect the direction of an aeroplane or airship.

The whole of this great development in the detection of electric waves and the enormous advance in the sensitiveness of our means of detecting them, had sprung out of researches begun in the laboratory of University College so far back as 1904.

Niagara Falls.—The monthly meeting of the Dublin Rotary Club took place on the 20th inst., the President (Mr. Alfred Fannin) in the chair. The chief item of the evening was an address by Mr. F. A. F. Fitzgerald on the development of electrical power from Niagara. Mr. Fitzgerald had spent the last 25 years in Niagara Falls City, during which time he had been actively engaged in the development work which formed the matter of his address. He described the various difficulties which had been overcome by the skill and pertinacity of the engineers, and summed up the results down to date—namely, the utilisation of about 300,000 H.P. in the manufacture of aluminium, carborundum and graphite, in addition to the distribution of considerable power to the tramways, lighting, and other utilities of the surrounding district. On the Canadian side there is a popular movement towards the taking-over of Niagara's productive power by the State.

Gas Fuel.—Mr. C. Carrington Barber, works engineer, Birmingham Corporation gas works, Saltley, is the new president of the Midland Junior Gas Association, which opened its session on Saturday last at Birmingham. In his presidential address, Mr. Barber strongly urged the need for conservation of fuel. In the past, he said, it had been the custom of those engaged in the gas industry to regard electricity as their competitor, but he thought that, in the future, the generation of electricity and the production of gas would be a joint industry. If we were to obtain the most out of our coal resources, then coal would be carbonised, and the gas converted into electrical power, and the by-products, which to-day were lost at the power stations, would be recovered.

Appointments Vacant.—Ticket and general traffic clerk (£140) for the Exeter Corporation tramways department; mains foreman for the Farnworth U.D.C. electricity department; principal of Wolverhampton Corporation Technical School (£750); shift engineer (72s.) for the Whitehaven Corporation electricity department; testing assistant and fitter for Torquay Corporation Electricity Department; city electrical engineer (£700) for the Port Elizabeth (S.A.) Corporation Electricity Undertaking. See our advertisement pages to-day.

Educational.—Manchester University.—An appeal is being made to industrial concerns for funds to meet pressing needs for development in various departments, including the scientific and engineering department, and in advanced training and research.

Inquiries.—Makers of Fox's cement for insulators are asked for.

New Fluorescent Screens for Radioscopy.—According to a note recently presented to the French Academy of Sciences, Messrs. P. Roubertie and A. Nemirovsky have succeeded in replacing barium platino-cyanide for fluorescent screens by the tungstates of magnesia. The new screens, which are insensitive to physical and atmospheric agents, give a white luminescence, and the radioscoped body shows up black. This greatly facilitates examination, and it is thought it may be possible in future to photograph, even by the kinematograph, the images thus obtained.—*Technical Review.*

An Electric Thief-Catcher.—By means of what the Marylebone magistrate described as a clever device, Detective sergeant Lawrence arrested a man whom he accused of stealing a wallet from his overcoat pocket. Lawrence attended the gymnasium of the Ministry of Pensions at Lancaster Gate, and left his wallet in the coat pocket when he went in for treatment. Before he left, however, he attached an electric wire to the wallet, a battery being at one end and a loud buzzer at the other. He had been gone for only a short time when the buzzer sounded, and immediately he returned to his overcoat to find a man standing near by in amazement. The man was charged with the theft.

Industrial Councils.—A meeting of representatives of the electricity supply undertakings, both of local authorities and companies, and of Trade Unions representing employés in the electricity supply industry, was held at the Employment Exchange, Bristol, on Monday, October 27th, for the purpose of forming a District Council for the areas of Herefordshire, Gloucestershire, Somersetshire, Wiltshire, and a strip of Devon (including Barnstaple, Ilfracombe and Lynton) in connection with the National Industrial Council for the electricity supply industry set up under the Whitley Report.

Representatives were present from the undertakings in the following towns:—Bristol, Bath, Cheltenham, Frome, Gloucester, Salisbury, Swindon, Taunton, and Weston-super-Mare, and the following Trade Unions were also represented: National Union of General Workers, Electrical Trades Union, Workers' Union, Amalgamated Society of Toolmakers, Amalgamated Society of Gas, Municipal and General Workers, Amalgamated Society of Tramway and Vehicle Workers, and the National Union of Enginemen. Mr. G. Smith, of the Ministry of Labour, was also present.

The constitution setting out the functions and conduct of business of the District Council which had been circulated was approved and adopted. The officers elected to serve on the Council were:—Hon. chairman, Mr. H. Faraday Proctor; hon. vice-chairman, Mr. G. W. Betteridge (district secretary of the Gas and Municipal Workers); joint hon. secretaries, Mr. Thos. H. Gait (Bristol Corporation Electricity Department), Mr. A. Hawker (local secretary, Union of General Workers). The official address of the Council is: The Electricity Department, The Exchange, Bristol.

Diesel Engine Users' Association.—Members and others interested in the work of the Diesel Engine Users' Association met at dinner at the Connaught Rooms, London, W.C., on October 23rd. In proposing the toast of the "Diesel Engine Users' Association," Sir Frank Heath, K.C.B., secretary to the Department of Scientific and Industrial Research, referred to the proposal that an Association should be formed to carry out research work on liquid fuels for Diesel and semi-Diesel oil engines under the Government scheme for industrial research. He understood the whole question had been discussed and considered at the meeting of the Diesel Engine Users' Association, which had been held that day. Sir Frank Heath emphasised the fact that this was an association of users. In dealing with the fuel problem, if the user and the fuel producer could combine and obtain an interchange of knowledge, then of necessity success would be far more easily attainable. He noted with approval that it was the intention of the Association to invite the co-operation of fuel producers and oil-engine makers in connection with research work for fuel oils best suited to their purpose. He assured the members that his department of the Government would be pleased to assist them in this matter in a substantial way. The Fuel Research Board was now working on the question of treating coal in such a manner as to produce a fuel oil suitable for use in internal-combustion engines, and he thought that the work which it was carrying out ought to be of very great assistance to the Diesel Engine Users' Association.

Mr. Napier Prentice, A.I.E.E., president, responded for the association. Major.-Gen. Sir G. K. Scott Moncrieff, K.C.B., K.C.M.G., C.I.E., referred to the possibilities of oil production from the shale deposits in West Norfolk. Admiral Sir Edmond Slade, K.C.I.E., K.C.V.O., referred to the large area of oil-bearing country in Persia as equivalent in extent to the whole of France and Germany together, and generally to the possibilities of oil production in the British Empire. He considered that the absolute importance of economy in consumption would necessarily lead to a great extension of the use of internal-combustion engines in maritime practice. Mr. J. L. Major spoke on the subject of tar oils, and referred to the large demand for creosote for other than fuel purposes. Mr. Charles Day and Mr. Guy Petter gave some interesting information concerning the Diesel and semi-Diesel engine industries. Among others who attended the dinner were Sir George Beilby, F.R.S., Mr. Alexander Richardson, M.P., Mr. C. H. Wordingham, C.B.E., Mr. Michael Longridge, Mr. John Belliss, Dr. W. R. Ormandy, Prof. J. S. S. Brame, Mr. E. H. Cunningham Craig, Mr. H. W. Robinson, &c.

Locomotive Drivers' Wages.—A special meeting at Leeds last week of the Society of Locomotive Engineers and Firemen, of which Mr. J. H. Bromley is secretary, made the following demands:—Rent allowance of 7s. 6d. a week, in addition to wages. Yearly holiday, with pay, of 14 days—after six months' service. Allowance of an extra day for working on a Bank Holiday. Enginemen, motormen, assistant drivers, firemen, and electric train men, if put on new work owing to ill health or defective sight caused by their employment, to be paid not less than before. If the Rent Restriction Act is repealed and house rents raised, it is said that the claim for rent allowance will be pushed forward, irrespective of the national programme. It was decided to take up a definite stand on the question of lodging away from home, and to refuse to undertake journeys which involve this practice.

Pathological Effects of Electricity.—The knowledge of the pathological effects of electric currents has been extended by the experience gained during the war, and the information collected shows the desirability of the close co-operation of the electrician and the doctor to improve methods of diminishing the dangers associated with the use of electric currents. It is suggested in Germany that an electro-hygienic laboratory should be founded for investigations in this field. Referring to the use of charged fences during the war, it is stated that the applied voltage of 1,000 volts proved to be fatal in some instances and quite harmless in others. An important factor is the preparedness for a shock, and a contact that would be fatal to an unexpectant victim might be relatively harmless if he had been adequately warned. This is borne out by experiments made on cats. In other experiments carried out on animals it was possible to demonstrate differences in the effects caused by direct and alternating current, the former giving simple shocks, whereas the latter consistently produced typical epileptic symptoms. Very often the victims of shocks are only apparently dead, and immediate and correctly applied artificial respiration may restore life. The effects of electric shocks are classified under numerous headings, and it is pointed out that the length of time taken for symptoms to appear, and their time of duration, vary greatly from case to case. A number of unusual cases of injuries due to electricity in different forms that occurred during the war are described in *Elektrotechnik und Maschinenbau.—Technical Review.*

Stopping Runaway Tramcars.—As we go to Press, we have received the following letter from Mr. W. G. Stuart, of Trethomas, Mon.:—To-day's news describes how two women have been very seriously injured through leaping from a runaway tramcar at Nottingham. The incident brings to my mind a very simple and effective method of checking the speed of any "two-motor" car which is out of control on a down grade owing to defective brakes or skidding wheels.

Every motorman's instruction book should refer to this method, which is as follows:—

First: Knock out the canopy circuit-breaker.

Second: Pull reversing lever to reverse position.

Third: Move controller arm to first "parallel" notch.

The result is to cause one motor to become a generator driven by the momentum of the car. This machine, being connected in parallel with the other, causes it to run as a motor, but, owing to the reversing lever having been thrown "back," the pair of wheels driven by this motor will revolve, or tend to revolve, in a direction opposite to that of a car descending a hill.

Of course, the car will not remain stationary, but will make a series of short runs, slowing down sufficiently for the brakes to be applied if they will now work, or allowing passengers to safely jump off, or else the car may reach the foot of the hill in the manner described.

If the first "parallel" notch does not give sufficient check, number two notch may be tried, but if carried too far there will be a very severe jolt, and extremely heavy stresses set up in gears, &c.

The scheme works regardless of whether the wheels have left the track or trolley jumped off the overhead wire.

The Electricity Supply Bill.—A deputation from the Federation of British Industries consisting of the president, Sir Vincent Caillard, Sir Harmood Banner, and Mr. Benjamin Talbot, recently met Sir John Snell and other officials of the Board of Trade in charge of the Electricity (Supply) Bill. The purpose of the deputation was to bring to the immediate notice of the Government the opinion of manufacturers, as represented by the Federation, on clause 9 of the Bill.

Sir John Snell said he was aware of the Federation amendments of this clause, and the Government had already tabled amendments which modified the original clause in the interests of manufacturers who were desirous of providing a supply of electricity for their own use. In the original clause no establishment or extension of an existing private generating station (*i.e.*, a station providing solely or mainly the supply of the owner) could be carried out without the approval of the Electricity Commissioners on the subjects of type of current, frequency, and pressure. The Government had agreed that this was going too far, and accordingly the restriction was now only to apply to the establishment of new generating stations.

The position of a group of persons wishing to set up a joint generating station was discussed. Mr. Benjamin Talbot stated that as the clause stood the iron and steel industry would be handicapped practically out of existence, as it would mean that they would not be able to use their waste energy from the coke ovens and blast furnaces, even though they wished to utilise this waste energy for the purposes of electric drive for their rolling mills.

Sir John Snell stated that the sanction of a joint generating station would be determined by the cost factor. If the manufacturers could provide electricity more cheaply than the district undertakers, no body of Commissioners dare refuse sanction to the establishment of the private station. He thought that in the interests of electrical development generally it would be more advantageous for the surplus (waste) energy to be sold to the local supply authority, especially as during the week-end there would be an excess of energy over the normal works requirements.

Mr. Talbot stated that that opened up the question of the most efficient utilisation of such waste, and it was his present opinion, which he hoped to put into practice, that the coke oven gas should be stored, and thus be available for the general domestic use of heating and lighting in the neighbourhood. Sir John Snell replied that he was of an open mind as to the most efficient method of fuel utilisation, and his action on such points would not be those of an electric fanatic, but would reflect, he hoped, the spirit of national and industrial efficiency.

Finally, Sir John Snell stated that he felt that Mr. Talbot had made out a definite case, and after consultation with his colleagues he would be prepared to recommend to the Home Secretary the introduction of amendments which he hoped would cover the points raised.—*F.B.I. Bulletin.*

The Bill was, on October 28th, considered by a Standing Committee of the House of Commons, with Sir Samuel Roberts in the chair. Clause 9 places restrictions on the establishment of new generating stations. It provides that "it shall not be lawful for any authority, company, or person, except a district electricity board, to establish a new, or extend an existing, generating station without the consent of the Electricity Commissioners, but this restriction shall not apply to the establishment or extension of a private generating station, provided that the owner thereof shall comply with any regulations made by the Electricity Commissioners as to the type of current, frequency, and pressure to be used." Mr. G. Balfour moved to omit the words "provided that the owner thereof shall comply with any regulations made by the Electricity Commissioners as to the type of current, frequency, and pressure to be used." There was a danger that the trade and industry of the country would be hampered by the Bill's provisions. The Home Secretary talked very airily, but all that he said was wrong. Mr. Hopkinson feared that the Home Secretary had been misled by his technical advisers. Mr. Shortt (Home Secretary), who was in charge of the Bill, said he hoped the amendment would not be accepted; if it was, the Electricity Commissioners would be divested of all power over private generating stations. It was essential for the purpose of a cheap and efficient supply that the central body should supply as many consumers as possible. On a division the amendment was rejected.

Reunion Dinner of Signal Co., R.N.D.—As previously announced, the association formed at Oxney Bottom is holding a reunion dinner on November 5th; tickets can be had (price 10s. 6d.) from Mr. E. A. Gordon, hon. secretary of the Banghvuelyan Association, at 9, Finchley Road, London, N.W. 8.

OUR PERSONAL COLUMN.

The Editors invite electrital engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Aldershot U.D.C. has increased the salary of the electrical engineer from £400 per annum to £500, with three annual increments of £25 to £575.

Mr. A. NICHOLS MOORE, the Newport borough electrical engineer, fell off a motor bicycle on Stow Hill, and is suffering from concussion of the brain. He is lying at his residence in Stow Park Avenue.

Mr. AMBROSE FOSTER, present assistant manager of the Tees-side tramway system, has been recommended for appointment, at £600 per annum, as manager of the Stockton and Thornaby portion upon the municipalisation of the system taking place in January. The appointment has to be confirmed by the Stockton and Thornaby Corporations.

For the post of tramways manager to the Middlesbrough Corporation (which is exercising the right to take over the privately-owned system in the borough), Mr. H. G. JENKEN, A.M.I.E.E., engineering assistant, Leeds City Tramways, has been appointed by the General Purposes Committee at £750 per annum. Mr. Jeken has held his present position at Leeds since 1897. In 1892 he obtained the post of engineer in charge to the Yorkshire House-to-House Electricity Supply Co., which was subsequently taken over by the Leeds Corporation. In 1894 he was appointed assistant engineer to the Halifax Corporation, and left after three years to take up his present position. In 1917 and 1918 his services were loaned by the Leeds Corporation to the Government, and he was appointed by the Admiralty Labour Department district director in charge of the East Riding and Lincolnshire area, with a staff of technical officers under him dealing with labour disputes and questions, reports of firms carrying out Admiralty contracts, and the installation of labour-saving machinery in shipbuilding and engineering establishments.

After some discussion, on Monday last, the Middlesbrough Council confirmed the appointment of Mr. H. G. JEKEN as tramway manager.

General.—The President of the Board of Trade has appointed Mr. A. R. DUNCAN to be Controller of Coalmines, in the place of Sir Evan Jones, whose resignation was recently announced.

The *Times* reports that Sir RICHARD REDMAYNE has resigned his post of head of the production branch and technical adviser to the Controller of Coalmines.

The *Financial Times* states that Captain J. PARSONS, who has been appointed signal and telegraph assistant to the chief engineer, Central Argentine Railway, Buenos Aires, was prior to 1915, when he joined the Forces, assistant signal and telegraph engineer of the Federated Malay States Railway.

In No. 2 of its Bulletin Service, which takes the place of the issue of October 11th, which did not appear because of the printers' strike, the *Electrical World* of New York says: "SAMUEL INSULL has been appointed chairman of the National Electric Light Association Committee on Electrification of Railroads. M. S. SLOAN will be chairman of the Committee on Electrical Resources of the Nation."

Sir HENRY ALEXANDER MIERS, D.Sc., F.R.S., Vice-chancellor of the University of Manchester, has been appointed by an Order of Council to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

Huddersfield T.C. has increased the salary of Mr. W. M. WILCOX, teacher of electrical engineering at the technical college, from £260 to £300 a year; and that of Mr. W. R. BOWER, teacher of physics and electrical engineering, from £322 to £350.

It is stated that Sir J. A. F. Aspinall has resigned his position as a director of the L. & Y. Railway Co. consequent upon his appointment as consulting mechanical engineer in the Ministry of Transport.

Captain and Acting-Major H. G. G. Clarke has relinquished his commission in the London Electrical Engineers on account of ill-health contracted on active service.

Captain G. A. M. Brown, M.B.E., North Riding Fortress Engineers (Electric Lights Company), who was a supernumerary officer of the regiment whilst employed as a general staff officer of the third grade, has been restored to the establishment of his corps.

Captain W. P. Digby, A.M.I.E.E., A.M.I.M.E., London Electrical Engineers, has been restored to the establishment of the Territorial Force (Royal Engineers). Capt. Digby received his commission in the London Electrical Engineers in May, 1910, and got his captaincy in June, 1916. He was borne on the supernumerary list whilst employed under the Ministry of Labour.

Mr. W. R. Cooper has relinquished his position as editor of *The Electrician*, but will continue his consulting practice as hitherto at 82, Victoria Street, London, S.W. 1. During his long occupancy of the editorial chair our relations with our contemporary have always been most cordial, and we regard his departure from that post with sincere regret.

Mr. A. Hutcheson, who has lately resigned from the Falkirk Iron Co., Ltd., was recently presented with a suit case and technical books by his staff colleagues, and an attaché case, clock, and fountain pen by the workpeople, the occasion being marked by a tea and concert. For eight years he has been the power engineer at the company's works, and for the last six months he was acting as shop foreman of the electric cooking and heating department. He leaves to take up a partnership in the firm of Messrs. Laird & Brown, electrical engineers, of 329, Crown Street, Glasgow. The vacancy has been filled by the appointment of Mr. Alexander Macmaster, who was for the duration of the war an engineer on one of H.M. ships. In conjunction with this appointment is that of Mr. James Middleton, late of Messrs. Vickers, Ltd., who was on important work on H.M. ships for this firm in the Yards of Messrs. John Brown & Co., Ltd., Clydebank, and takes up his new duties as chief electrician and tester in the electrical cooking and heating department of the Falkirk Iron Co., Ltd. Mr. John Miller has been appointed head draughtsman in the same department. He has had many years' experience in the design and construction of all classes of these electrical appliances, particularly of the heavier type. The Falkirk Iron Co., Ltd., are obviously alive to the great importance of the future of electricity as applied to cooking, heating, and industrial appliances.

Roll of Honour.—Corporal J. A. Dutton, M.M., Inniskilling Fusiliers, who has died from tuberculosis, was formerly on the staff of Messrs. Siemens Bros., of Stafford. He was discharged as unfit for service in November, 1917.

Mr. W. W. Blunt, who, as already announced, has retired from the Westinghouse Co. (Metropolitan-Vickers), was recently entertained to a farewell luncheon by a number of his friends at the Engineers' Club, Manchester. The gathering was presided over by Mr. J. A. Robertson, of Salford, who was supported by Mr. John Taylor, Mr. S. L. Pearce, Mr. Bertram Thomas, Mr. R. Blackmore, and other well-known engineers. The Chairman explained that the gathering was the outcome of a desire on the part of some of Mr. Blunt's friends outside the Westinghouse Co.—including power station engineers, marine engineers, and manufacturers—to mark the occasion of Mr. Blunt leaving this country to return to the United States. On behalf of a large number of subscribers, the Chairman presented Mr. Blunt with a solid silver inkstand and a platinum diamond brooch for Mrs. Blunt. In reply Mr. Blunt referred to his 23 years' association with the Westinghouse Co. and to the general development of electrical manufacturing during this period. Apologies for absence were received from Mr. W. W. Lackie, Mr. R. A. Chattock, Mr. J. A. Bell, Mr. J. Christie, Mr. Ernest Hatton, Mr. J. H. Hamilton, Mr. Arch. Page, and others.

Lieut A. H. Desforges, late R.A.F., has returned to Messrs. Siemens Bros. & Co., Ltd., Woolwich, after an absence of about three years on active service.

Obituary.—Mr. F. W. Allonby.—The death has occurred at Pekin of Mr. F. W. Allonby, electrical engineer, who was trained at Windermere Electricity Works. Later he joined the staff of Messrs. Vickers, Ltd., of Sheffield, for whom he went to South Australia in 1917 to superintend the erection of electric light installations. He afterwards proceeded to China, and he died on the eve of his return home. He was 32 years of age.

Sir Joseph Lawrence, Bt.—We regret to record that Sir Joseph Lawrence, Bt., passed away suddenly while travelling home by train on Friday night last. He was in his 72nd year. Sir Joseph was chairman of the Linotype Co. and the Manchester Ship Canal Co., and was in the early days interested in the British Westinghouse Electric & Manufacturing Co., Ltd., of Trafford Park. He was a very active worker in the interests of patent law reform, and took a prominent part in connection with the introduction and passage of the Patents Acts of 1902 and 1907.

Wills.—The late Mr. H. C. Edwards, retired superintendent of telegraphs, of Edinburgh, left £9,265.

NEW COMPANIES REGISTERED.

Q-Ozone Processes, Ltd. (159,675).—Private company. Registered October 16th. Capital, £10,000 in £1 shares. To acquire and deal with certain patents and rights relating to the use of ozone and chemical processes for various electrical, chemical, metallurgical, and commercial applications, &c. The subscribers (each with one share) are: J. R. Quain, 55, Effra Road, Brixton, S.W., electrical engineer; H. J. Wallis, 17, Victoria Street, S.W., clerk. Permanent governing director: J. R. Quain. Solicitor: B. A. C. Redden, 17, Victoria Street, S.W.

Marconi-Osram Valve Co., Ltd. (159,787).—Private company. Registered October 20th. Capital, £100,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical valves and other articles, instruments, apparatus and things used in connection with wireless telegraphy, and to carry on the business of electrical and general engineers, manufacturers of telegraphic works and appliances of all kinds, &c. The subscribers (each with one share) are: H. W. Corby, 2, Berkeley Court, N.8, chartered secretary; P. H. P. Wells, Elmside, Marlborough Hill, Harrow, secretary of General Electric Co., Ltd. The number of directors is to be either two or four, half to be appointed by Marconi's Wireless Telegraph Co., Ltd., and half by the General Electric Co., Ltd. Solicitors: Coward & Hawksley, Sons & Chance, 30, Mincing Lane, E.C. Registered office: Osram Works, Brook Green, Hammersmith, W.

Clock Tower Engineering Co., Ltd. (159,818).—Private company. Registered October 21st. Capital, £50,000 in 40,000 7½ per cent. cumulative preference shares of £1 each and 40,000 ordinary shares of 5s. each. To carry on the business of electrical and general engineers, electricians, engineers, founders, smiths, manufacturers, repairers, cleaners and storers of and dealers in aircraft of all kinds, automobiles, motors, &c. The subscribers (each with one £1 share) are: W. J. Payne, 11, Carlisle Street, Soho Square, W.1, designer; F. King, 11, Carlisle Street, Soho Square, W., engineer. The first directors are: W. J. Payne; Sarah P. Kennedy, Brampton Grange, Huntingdon; and C. H. Parker, Cedarholme, St. Margaret's. Qualification, £100. Secretary: G. F. Joseph. Registered office: 118, Victoria Street, Westminster, S.W.

British Scientific Industries, Ltd. (159,768).—Private company. Registered October 20th. Capital, £10,000 in £1 shares. Objects: To carry on the business of glue-pot dealers, workers in wood, vulcanite, rubber, leather, celluloid, and other materials, manufacturers of and dealers in illuminating apparatus and fittings, &c. The subscribers (each with one share) are: J. Brown, 18, Upper Mill Hill, Leeds, lamp merchant; D. M. Colman, Queen Anne's Mansions, S.W.1, member of Lloyds. The first directors are: J. Brown and D. M. Colman. Qualification, £500. Registered office: St. John's Works, Headingley Station, near Leeds.

Pinkey & Forster, Ltd. (159,795).—Private company. Registered October 20th. Capital, £5,000 in £1 shares. Objects: To take over the business of electrical engineers and contractors, carried on by R. B. T. Pinkey and R. A. Forster at 11, Princess Street, Newcastle-on-Tyne, as "Pinkey and Forster." The subscribers (each with one share) are: R. B. T. Pinkey, A.M.I.E.E., &c., 11, Princess Street, Newcastle-on-Tyne, electrical engineer; R. A. Forster, 11, Princess Street, Newcastle-on-Tyne, electrical engineer. The first directors are: R. B. T. Pinkey, A.M.I.E.E., &c., and R. A. Forster (both permanent). Qualification, £400. Secretary: A. S. Paris. Registered office: 11, Princess Street, Newcastle-on-Tyne.

E. R. Watts & Son, Ltd. (150,703).—Private company. Registered October 17th. Capital, £20,000 in £1 shares. To carry on the business of scientific instrument makers, &c., and to enter into an agreement with F. C. Watts, G. W. Watts, and J. L. Fearnley. The subscribers (each with one share) are: F. C. Watts, 123, Camberwell Road, S.E., scientific instrument maker; G. W. Watts, 123, Camberwell Road, S.E., scientific instrument maker; J. L. Fearnley, 123, Camberwell Road, S.E., scientific instrument maker. The first directors are: F. C. Watts, G. W. Watts, J. L. Fearnley, and P. L. Watts. The three first named are permanent managing directors. Qualification of managing directors, £1,000; of ordinary directors, £100. Solicitors: Bolton, Jobson & Yate Lee, 2, Temple Gardens, E.C.

Kartret Engineering Co., Ltd. (159,910).—Private company. Registered October 23rd. Capital, £25,000 in 24,000 7 per cent. cumulative preference shares of £1 each and 10,000 ordinary shares of 2s. each. To take over the business of an electrical and mechanical engineer carried on by V. G. Middleton at 7, Carteret Street, S.W., as the "Kartret Engineering Co." Agreement with said V. G. Middleton and C. J. Baker. The subscribers are: V. G. Middleton, Mirables, St. Lawrence, I. of W., electrical engineer and contractor, 1,000 preference shares; C. J. Baker, 7, Carteret Street, Westminster, electrical and mechanical engineer, 1,000 ordinary shares; H. Blofeld, The Woodlands, 43, Sydenham Hill, S.E.26, gentleman, 1,000 preference shares. First directors: V. G. Middleton, C. J. Baker, W. F. Furse, Harry Blofeld, and Hamilton Blofeld. The said Hamilton Blofeld may retain office whilst holding 2,000 prefrence and 1,000 ordinary shares. Qualification, 1,000 shares. Solicitors: Timbrell & Deighton, 98, Cannon Street, E.C. Registered office: 7, Carteret Street, Broadway, Westminster, S.W.1.

Couzens & Akers, Ltd. (159,819).—Private company. Registered October 21st. Capital, £10,000 in £1 shares (3,000 preference). Objects: To take over as from March 31st, 1919, the business of an electrical engineer carried on by R. E. Akers at 79, Southfield Road, Edgbaston. The subscribers (each with one share) are: E. A. Couzens, Lincoln's Inn, Corporation Street, Birmingham, engineer; R. E. Akers, 79, Southfield Road, Edgbaston, Birmingham, engineer. The first directors are: E. A. Couzens (governing director), J. W. Mayall, and R. E. Akers (all permanent). Secretary: J. W. Mayall. Solicitor: O. J. Snow, 2, Bennett's Hill, Birmingham.

R. J. Corporation, Ltd. (159,757).—Private company. Registered October 18th. Capital, £2,000 in £1 shares. To carry on the business of electrical, sanitary, mechanical, hydraulic, constructional, water, heat, light and motive power supply engineers, &c., and to enter into an agreement with J. Rose, I. Jascourt, F. A. Fraser, and F. H. Brewerton. The subscribers (each with one share) are: J. Rose, 44, Walden Street, New Road, E., chemist; I. Jascourt, 66, Greenfield Street, E.1, chemist, F. Brewerton, 370, High Road, Willesden Green, N.W., engineer. The first directors are: J. Rose, I. Gascourt, F. A. Fraser, and F. H. Brewerton. Qualification, £100. Solicitors: Boulton, Sons & Sandeman, 21a, Northampton Square, E.C.1.

E. Russells (Manchester), Ltd. (159,677).—Private company. Registered October 16th. Capital, £20,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in asbestos and insulating material, dealers in engineers' stores, oil refiners, chemical and dye manufacturers, manufacturers of and dealers in toilet requisites, powders and pills, pitch and tar manufacturers, manufacturers of and dealers in rubber, rubber heels and rubber substitutes, &c. The first directors are: R. Russell, "Acres," Middleton, Lancs., manufacturing chemist; and W. Stockdale, Davenport Park, Stockport, twine manufacturer. Registered office: Lands End Works, Rhodes, near Manchester.

Rushmores (1919), Ltd. (159,716).—Private company. Registered October 17th. Capital, £100,000 in 85,000 8 per cent. cumulative participating preference shares of £1 each, and 150,000 ordinary shares of 2s. each. Objects: To carry on the business of manufacturers, letters on hire, repairers and cleaners of and dealers in searchlights, and lamps of all kinds, magnetos, dynamos, self-starters, and other electrical devices and appliances, &c. The subscribers (each with one ordinary share) are: H. M. Organs, 6, Florence Road, Ealing Common, W., chartered secretary; H. S. Hinge, 182, Uxbridge Road, Hanwell, W.7, private secretary. The first directors are to be appointed by the subscribers. Qualification £100. Solicitor: C. H. Dodd, 16, Friar Street, Reading.

Electro-Metallurgical Extraction, Ltd. (159,732).—Registered October 17th. Capital, £30,000 in £1 shares. To manufacture, produce, extract, recover, distil, refine, make merchantable, sell, and deal in all manner of chemical elements, compounds, products, by-products, and residuals, &c., and to enter into an agreement with J. J. Collins. The subscribers (each with one share) are: H. l'Anson Jones, 62, London Wall, E.C., solicitor; J. Sims, 62, London Wall, E.C., solicitor; C. C. Tarrelli, 62, London Wall, E.C., solicitor; W. R. Smith, 6, Lawley Street, Clapton, E. 5, solicitor's clerk; E. J. Burrows, 29, Lyndhurst Road, Highams Park, Chingford, E. 4, solicitor's clerk; F. Mitcheuer, 37, Fontenoy Road, S.W. 12, solicitor's clerk; S. Humphreys, 19, Richmond Road, N. 2, solicitor's clerk. Minimum cash subscription seven shares. No directors had been appointed to October 16th. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.

CITY NOTES.

British Internal Combustion Engines, Ltd. Addressing the first annual meeting of this company, held in London last week, Mr. R. H. Wheeler said that their investments in shares of companies, £127,800, represented their holdings at cost in the Aster Engineering Co., Ltd., in which they held over three-quarters of the issued capital, and the Green Engine Co., Ltd., which they held entirely. The Green engine is expected to take a foremost part in the great future of aircraft. In regard to the position of the Aster Engineering Co., Ltd., since they became interested in it its dividend had been doubled. That company made the Aster internal combustion engine for electric generating sets, electric welding, wireless telegraphy, ships' lighting, &c., and it was fully booked up with profitable orders for more than a year ahead, and it was further developing the manufacture and home and foreign markets for its specialities. The works were being enlarged as rapidly as possible, and additional machinery was being installed. The chairman said that their associated companies were pioneers in the development of the internal combustion engine for aviation, road transport, and the generation of electricity, and they were therefore in a position to take full advantage of the great future before the industry. This company had developed an agency and trading business which would shortly add materially to its income. In this connection it was proposed to form a separate company which would be owned and controlled by this company.

Edison Swan Electric Co., Ltd. The directors in their report for the year ended June 30th, 1919, show that the profit was £137,442, plus £50,265 brought forward, making £187,708. Out of this the following payments were made:—

Interest on both classes of debenture stock	£18,649
Armistice wages grant	3,358
7 per cent. dividend on participating preference shares to January 31st, 1919	7,000
3 per cent. interim dividend upon ordinary shares, paid June 16th, 1919	11,813

The balance of £146,888 is to be appropriated as follows:—

Special munitions plant, depreciation	£35,361
Balance of expenses of issue of preference shares	5,645
Further 3 per cent. dividend on participating preference shares (making 10 per cent. for the year)	3,000
Dividend of 7 per cent. on ordinary shares (making 10 per cent. for the year exclusive of shares issued in May, 1919)	27,755
Provision for debenture stock sinking fund	13,414
To be carried forward, subject to excess profits duty	85,176 61,711
	£146,887

Considering the inevitable dislocation of manufacturing, brought about in the change over from war to peace conditions in the year under review, the directors consider that the above results are favourable. The works are fully employed, and should continue to be so if no unforeseen circumstances arise. As shown it is proposed to appropriate £35,361 from profits as depreciation on plant and buildings installed for war purposes. The capital expenditure, before providing for depreciation, is £39,641, of which £15,013 is in respect of additions to land and buildings, and £24,628 to plant and machinery. These extensions include an additional gasholder of a capacity of 75,000 cu. ft. of gas, together with the necessary retorts, &c., additions and improvements to the glass works, new shops for the manufacture of electrical accumulators, heating and cooking apparatus, bells and telephones, additions to the electroplating department, and considerable extensions of various other departments.

The company having entered into certain commercial arrangements with the Enfield Electric Cable Manufacturing Co., Ltd., a concern with extensive works at Enfield, a new company has been formed under the title "Enfield Ediswan Electric Cable Works, Ltd.," the Edison Swan Co. subscribing for 50,000 £1 ordinary shares therein.

A provisional agreement has been entered into with Brotherton Tubes and Conduits, Ltd., which provides for the subscription by the Edison Swan Co. of 25,000 preference shares of £1 each of the Brotherton Co., and the change of name by that company to "Brotherton Ediswan Tubes and Conduits, Ltd."

The above investments will give the Edison Swan Co. direct interests in the manufacture of cables, wire, tubes, and conduits, and should materially increase its business in these classes of goods, and will prove beneficial in other directions. The freehold property in the north of London, acquired for the purpose of manufacturing dry cells and batteries, the purchase of which was referred to in the directors' previous year's report, has since been disposed of at a profit, and the manufacture of these articles transferred to the Ponders End works. The expansion of the company's business makes it necessary that further capital should be provided, and an extraordinary general meeting is to be held on November 3rd, following the annual meeting, for the purpose of increasing the capital. It is proposed to increase the capital of the company by the creation of 500,000 ordinary shares of £1 each. This will increase the capital to £1,198,307, and if the meeting gives approval to the resolution a portion of the new shares will be issued at an early date.

Marconi's Wireless Telegraph Co., Ltd. This company announces that, subject to resolutions which will be submitted to the shareholders of the American Marconi Co. in general meeting on November 20th next being approved, they have sold to the General Electric Co., of New York, U.S.A., the whole of their shareholding in the American Marconi Co. at an advantageous price. A new radio corporation has been organised in America entitled "The Radio Corporation of America," which it is proposed will purchase the assets of the American Marconi Co. This corporation will have a capital of five million 7 per cent. cumulative preferred shares of $5 each and five million ordinary shares without capital denomination. The American Marconi shareholders will receive one 7 per cent. cumulative preferred share and one ordinary share for each $5 share at present held by them in the American Marconi Co. An agreement has been entered into by Marconi's Wireless Telegraph Co., Ltd., with the General Electric Co., of New York, and the Radio Corporation of America of a very important, far-reaching, and highly satisfactory nature, which provides, *inter alia*, that the English Marconi Co. secures the sole rights for the whole of the British Empire and a licence for other parts of the world other than the United States of America of all radio patents and inventions of the General Electric Co., of New York, and the Radio Corporation of America, past, present, and future, until the end of 1945, which embraces the Alexanderson high frequency alternator. The directors of Marconi's Wireless Telegraph Co., Ltd., recommend those who hold shares in the American Marconi Co. to send their proxies duly executed to: Mr. Godfrey C. Isaacs, director, M.W.T. Co. of America, Marconi House, Strand, W.C. 2. The proxy form will be forwarded to them in the course of the next few days accompanied by a circular issued by the American Marconi Co.

Montreal Light, Heat & Power Co.—The Montreal Light, Heat & Power Consolidated Co., operating the above company, have declared a dividend of 2 per cent. for the quarter ended October 31st. The consolidated company have declared a dividend of 1¼ per cent. for the same quarter.

Electric Supply Co. of Victoria, Ltd.—The accounts for the year ended March 31st, 1919, show that the revenue was £101,220, against £95,009 in the previous year; the expenditure £67,159, against £63,567 in the previous year; and the gross profit £34,061, against £31,443. Lamps connected 252,407, against 211,746 in the previous year; tramway passengers 4,898,102, against 4,881,924. The balance to the credit of profit and loss account is £32,234 plus £20,923 brought forward, making £53,157, less £14,688 for debenture interest and charges. It is proposed to write off loss on realisation of obsolete assets £2,618; to put to reserve for estimated liability under Federal income tax £1,214 (this is a fresh item); to pay on account of arrears of preference dividend £10,500; and to carry forward £24,136. The report says: "The payment of income tax by the company in both this country and Australia has become a matter of serious hardship to the company, and is engaging, in conjunction with other companies and firms trading in Australia, the attention of the directors." Debenture stock redeemed to date £73,210. The meeting was held in London on October 16th.

Buenos Aires Port and City Tramways Co., Ltd.—The report for the year ended June 30th, 1918, states that the conditions under which the undertaking has been carried on by the receiver's representative in Buenos Aires have been more unfavourable than during the previous periods, and as against surpluses of £9,335 to June 30th, 1916, and £3,810 to June 30th, 1917, the year now under review shows a debit of £227, after charging the receiver's remuneration for one year to December 30th, 1917, only, and without providing for any administration expenses of the company (other than audit fee), or any interest on debenture debt, or making any allocation for depreciation. The accrued amount for administration expenses to June 30th, 1918, is £5,800. No scheme of reconstruction has yet been proposed for the consideration of the debenture stock and bondholders.—*Financial Times.*

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—Newcastle-upon-Tyne Electric Supply Co., Ltd.—66,000 additional 5 per cent. preference shares of £1 each, fully paid, Nos. 1,288,287 to 1,354,286.

Claud Hamilton, Ltd.—According to the "Financial Times" the directors recommend a dividend of 7½ per cent. on the ordinary shares for the year ended April last, also a bonus of similar amount, both less tax, that £5,000 be transferred to reserve, and the balance, £10,732, carried forward. For the previous year the ordinary dividend was the same, with bonus of 5 per cent.

Marconi Wireless Telegraph Co. of Canada.—The accounts for 1918 show a profit of $138,648. After meeting interest on advances and appropriating $18,216 for depreciation, &c., the credit balance of $198,414 brought down is increased to $293,787.

Vera Cruz Electric Light, Power & Traction Co., Ltd.—Dividend of 2½ per cent. for half-year, making 7½ per cent. for year; £10,000 to depreciation and reserve account; £23,399 forward.

Callenders' Share & Investment Trust, Ltd.—Dividend of 3½ per cent., less income tax, for half-year, making 6½ per cent. for year; £500 to reserve; £740 is written off preliminary expenses and cost of debenture stock issue; £5,603 is carried forward.

Erinoid, Ltd.—Dividend 15 per cent., less income tax, for the year. £10,284 to reserve, £1,068 forward.

STOCKS AND SHARES.

TUESDAY EVENING.

SOME of the markets in the Stock Exchange are very quiet. Others have more to do than they can cope with. This is literally correct. The question of physical possibility (and impossibility) comes into play in the oil market, while in rubber shares the rush at the beginning of the week was so extraordinary that a certain amount of business had perforce to be left over to be dealt with on the following day, owing to the fact that men have but one head and two hands apiece. Industrials of all kinds continue to be high in favour. The revised estimates of the national expenditure for the current year came as an unpleasant shock, but everything that indicates increase of taxation is only one more stimulus to speculation for differences, and to what is euphemistically called "purchases for capital appreciation."

In these circumstances, gilt-edged stocks are dullish and Home Railways stagnant. Districts have gone back to 22½, Metropolitans to 25, and Underground incomes to 93½. There is no heart in, or hope for, Home Railway stocks. Even preferences can be bought at prices that offer 6½ per cent. on the money, and investors will not even look at these. Ten years or more ago the present writer sat excellently lunching with a man as well known as any in the electrical world, and with a foresight that subsequent events have justified to the hilt, the electrical authority declared that the doom of railways was in sight, their place to be taken by that of the road. "Not a penny of my money will I invest in railway stocks," said he decisively. It sounded rather fantastic in those days. It sounds almost prosaic and obvious to-day. Railways, like excellent lunches, are passing into things of the past.

Descending from the sublime to the mundane, the Edison Swan dividend of ten per cent. and the proposed creation of half a million new shares of £1 apiece have had a good effect upon the price. After hardening to 27s. bid, the quotation eased off to 26s. 3d., and some of the critics began to hint that a more discreet policy would have been to pay a lower dividend and to have wiped out part of the £390,000 for goodwill, &c. The net profit of £115,400 is £24,000 up, and the carry-forward is £11,400 higher at £61,700. The reserve fund, however, is somewhat scantily treated, and with the rapid expansion of business, as exemplified in the need for the additional capital, calls for the fortifying as much as possible of the balance sheet. Doubtless the issue of new shares will be made at a price affording shareholders a bonus.

Improvement to 29s. in Siemens shares gives point to the revived talk of a possible taking-over of the company by the English Electric. The rumour, when first started some month or two ago, led to a rise in Siemens from 25s. to 29s. 6d., from which latter price there was a sagging-off to 26s. 9d. until gossip and the quotation revived hand in hand. It is now said that the deal has been finally arranged, and that details will be out in the course of a few days' time. Electrical manufacturing shares keep very hard, and there is market talk of other possibilities materialising that are sufficiently good to make such shares worth holding.

British Aluminium have advanced 1-16th. Electric Constructions are similarly better. In the engineering group, Babcock & Wilcox are quoted 2½ ex the rights; this is lower on the week. The rights are quoted 15s. premium, and it looks as though people are selling the old shares in order to take up the new.

The statement of the Chancellor of the Exchequer in regard to the national deficit was followed immediately by further improvement in cable issues upon which dividends are paid free of tax. Western Telegraphs are 7s. 6d. higher, Eastern Ordinary 4 points, Globes 10s., Chile shares 2s. 6d., and United River Plate Telephones the same. The only fall in the group is ½ in Anglo-American preferred. Telegraph Constructions have not moved for weeks past, and at 25 they present a very fair investment. The next dividend may not be changed, but prospects point to improvement in the further future. Marconis have been one of the most active spots in the Stock Exchange, and at 6 9-16 are the fraction to the good. The rise was based on the news that the General Electric Co., of New York, had made an offer to the Marconi Co. for the American Marconi shares held by the former undertaking. American Marconis rose to 35s. before reacting to 34s. 3d., and the whole of the Marconi list has been strengthened by the incident.

Electricity supply shares are inclined to be dull, although there is no particular amount of business in them. In the foreign Traction group, British Columbia issues are better, while Brazil Tractions and the Mexican bonds are lower on the week. There has been a remarkable outburst of activity in rubber shares, where the recent railway strike has kindled imagination in the uses to which The Road will be put in future, and the advertisement has given a fillip to such things as rubber, oil, and transport shares generally. Armament shares are quiet, and there is not much doing in iron and steel shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Oct. 28, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	6	—	£6 13 4
Charing Cross Ordinary	4	4	5½	—	6 8 0
do. do. do 4½ Pref.	4½	4½	3	—	7 10 0
Chelsea	5	3	3	—	5 0 0
City of London	8	8	11½	—	7 3 10
do. do. 6 per cent. Pref.	6	6	9½	—	6 9 9
County of London	7	7	9½	—	7 5 5
do do. 6 per cent. Pref.	6	6	9½	—	6 11 9
Kensington Ordinary	7	6	4½	—	6 6 4
London Electric	Nil	Nil	1½	—	
do. do. 6 per cent. Pref.	6	6	5½	—	8 11 6
Metropolitan	4	5	3½	—	7 15 10
do. 4½ per cent. Pref.	4½	4½	3⅝	—	7 1 3
St. James' and Pall Mall	9	10	6½	—	8 3 4
South London	5	5	2½	—	7 8 8
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	5½	—	7 2 2
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	94	— ½	6 7 8
do. Def.	1½	33/6	22½	—	7 9 0
Chile Telephone	8	8	6½	—	5 18 6
Cuba Sub. Crd.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16½	+ ½	*4 19 3
Eastern Tel. Ord.	8	8	164½xd	+4	*4 17 3
Globe Tel. and T. Ord.	7	8	16½	+ ½	*4 18 6
do. do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	22	22	20	—	7 11 9
Indo-European	13	13	47½	—	6 16 10
Marconi	20	25	6 9/16	+ 3/16	3 16 3
Oriental Telephone Ord.	18	10	2 1/16	—	4 14 1
United R. Plate Tel.	8	8	8	+ ½	*5 0 0
West India and Panama	1/3	1/3	1½	— 1/16	*5 0 0
Western Telegraph	8	8	17⅛	+ ⅛	*4 13 6
HOME RAILS.					
Central London Ord. Assented	4	4	60	— ½	6 13 4
Metropolitan	1	1½	25	— ½	5 0 0
do. District	Nil	Nil	22½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2⅝	—	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	4	5	93½	— ½	*5 7 0
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	— ½	7 1 2
Anglo-Arg. Trams. First Pref.	5½	Nil	3½	—	—
do. do. 2nd Pref.	—	—	3	+ ½	—
do. do. 5 Deb.	5	5	66½	—	7 10 6
Brazil Tractions	—	—	58½	—1	—
Bombay Electric Pref.	6	6	12½	—	4 18 0
British Columbia Elec. Rly. Pfce.	5	5	56½	—	8 17 0
do. do. Preferrred	Nil	2½	45½	+1	5 10 0
do. do. Deferred	Nil	Nil	41½	+2	Nil
do. do. Deb.	4½	4½	61½	—	6 18 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	49	—	Nil
do. 6 per cent. Bonds	Nil	Nil	38½	—2	Nil
Mexican Light Common	Nil	Nil	32½	—	Nil
do. Pref.	Nil	Nil	32½	—	Nil
do. 1st Bonds	Nil	Nil	52½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	2½xd	— ½	*5 9 1
British Aluminium Ord.	10	10	11½	+ 1/16	5 10 4
British Insulated Ord.	25	12	2½	—	5 19 4
Callenders	25	25	8½	—	7 2 10
,, 6½ Pref.	5	6	5	— ½	6 10 0
Castner Kellner	25	20	2½	—	8 0 0
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	10	1⅝	+ 1/16	7 12 4
do. do. 5 per cent. Deb.	4	5	81½	—	6 2 9
Electric Construction	10	10	1⅝	+ 1/16	8 9 0
Gen. Elec. Pref.	6	6½	20/6	—	6 6 10
do. Ord.	10	10	2	—	*5 0 0
Henley	25	25	2½	—	5 11 1
do. 4½ Pref.	4½	4½	3⅝	—	6 4 2
India-Rubber	10	10	17½	—	*5 14 8
Met.-Vickers Pref.	—	—	3	—	5 6 8
Siemens Ord.	—	10	29/-	+ 1/6	*6 18 0
Telegraph Con.	20	20	25	—	*4 17 0

* Dividends paid free of Income Tax.

THE IMPROVEMENT OF POWER FACTOR.

By E. W. DOREY.

(*Continued from page* 539.)

(*b*) *Rotary Condensers.*—For power factor correction on a large scale the rotary condenser comes to the fore. In a treatise on "Power Factor Correction," issued by the American Westinghouse Co., and written by Mr. Nicholas Stahl, a description of numerous large rotary condensers is given; these include two of 15,000 K.V.A. each, designed to run at zero power factor, leading or lagging, at a speed of 375 R.P.M. These condensers were installed not so much for the correction of power factor or control of a particular load, as for the regulation of the voltage of the transmission line. It will be seen, therefore, that our friends on the other side are keenly alive to the necessity of grappling seriously with this important question.

In the States and Canada the problem is somewhat different to that on this side in that huge amounts of power are transmitted by overhead, and this plan lends itself to the employment of very large condensers. There are, however, in this country numbers of cases where a rotary condenser, suitably installed on the network (overhead or underground), would solve the voltage-regulation problem. In such cases the condenser would have to be under the control of the supply undertaking, and, therefore, installed at the cost of the latter.

On the other hand, it is desirable to give the consumer of large amounts of power the necessary inducement to install a rotary (or other) condenser, as this in itself will greatly relieve the regulation problem.

The rotary condenser is a specially-designed synchronous motor running light, and over-excited to give its normal output in K.V.A. at approximately zero power factor leading; the condenser needs excitation from a separate source or direct-coupled exciter, and for starting purposes a motor, or other starting device, must be employed.

The power consumption of the machine is that due to losses in excitation, windage, friction, &c., and when running at full load it will have the following approximate values:—

500 K.V.A. output	... ...	27 KW.
750 „ „	... ...	35 KW.
1,000 „ „	... ...	50 KW.

To show that from the consumer's standpoint it would be a paying proposition to install a rotary condenser with its somewhat high efficiency loss, let us take an example as follows:—

Consumer's load 4,000 KW. at 80 per cent. power factor, = 5,000 K.V.A.

Condensers installed, two, each of 1,000 K.V.A. = 2,000 K.V.A.

Referring to the vector diagram (fig. 5), the load in KW. is represented by A B, and the load in K.V.A. by A C; the wattless lagging component of the load is, therefore, B C, or 3,014 K.V.A. (which represents the capacity of the condensers necessary to raise the power factor to unity); D C represents the losses, and F C the output of the two condensers. The resultant load in K.V.A. on the mains is represented by A F. A solution of this problem will show that the new angle of lag is 14°, the equivalent of a power factor of 97 per cent.

Thus by the installation of these two condensers, the power factor of the consumer's load of 4,000 KW. would be raised from 80 per cent. to 97 per cent.

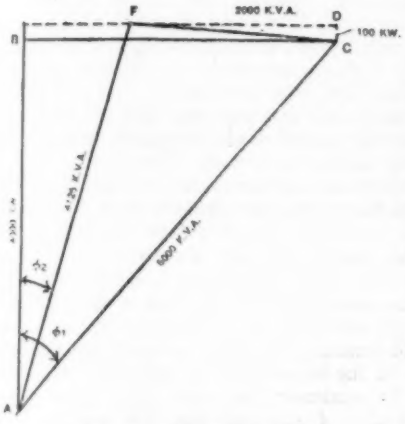

Fig. 5.—Vector Diagram.

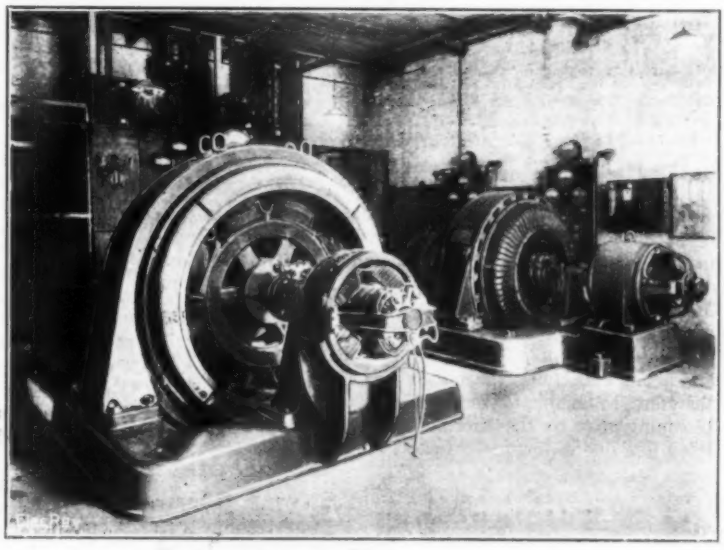

Fig. 6.—B.T.H. Rotary Condensers in Shell Factory.

Assuming rates of charge as set out in the foregoing schedule, the saving to the consumer would amount to the following:—

	£ s.	Per quarter.
4,000 KW. at 80% P.F. = 5,000 K.V.A. at 16s.	4,000 0	
4,000 KW. at 97% P.F. = 4,125 K.V.A. at 14s.	2,887 10	
		£ s.
Difference		1,112 10
Less—		
Losses in each machine of 50 KW., thereby increasing demand by 100 KW. chargeable at 14s. per KW.-quarter	70 0	
Energy losses 100 KW. × 10 hours per day × 75 days per quarter × 0·35d. per unit, say	110 0	
		180 0
Saving...		£932 10

Saving per annum is, therefore, 4 × £932 10s. ... £3,730

A consumer with a load of this description should obtain a special rate for the losses in the condenser, and, in fact, this is done in cases known to the writer, hence the assumed 0·35d. per unit.

Even at the present enhanced prices it should be possible, with a saving as above, to recover the cost of the installation of the two 1,000-K.V.A. condensers in less than 18 months. This should be good business, even for a profiteer.

The illustration, fig. 6, is of two rotary condensers installed during the war at a large shell works in the South of England, at the expense of the consumers. Both condensers are of B.T.H. make, one being of 700 K.V.A., and the

other of 600 K.V.A. output. The machines are connected direct to the bus-bars in the consumers' distribution station, the supply being at 415 volts, three-phase. The 600-K.V.A. set on the left of the view was bought second-hand, and, being two-phase, a "Scott-connected" two-phase-three-phase transformer is connected between the set and the bars. The one-line diagram, fig. 7, will show how the sets are connected up.

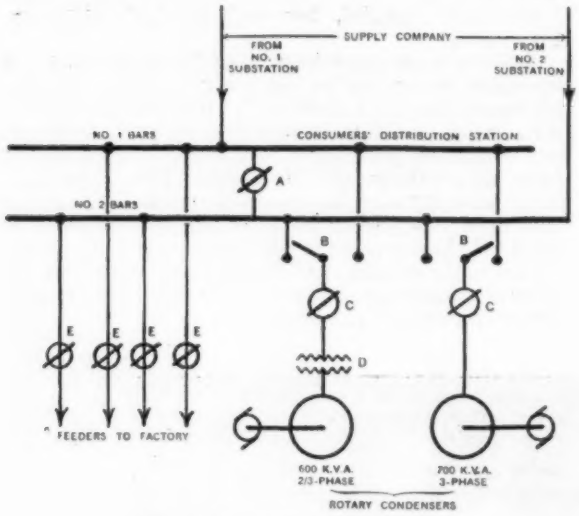

Fig. 7.—Diagram of Connections.

(*c*) *Static Condensers.*—In this country the static condenser is rapidly pressing to the forefront for the improvement of power factor in both large and small installations, and this is evidenced by the statistics of the principal makers, Messrs. The British Insulated & Helsby Cables, Ltd., which show that the condensers built by them in 1919 (to September) total more than 27 times their output for 1914, and about four times the output of 1918. It is pleasing, therefore, to be able to record that this country is at last becoming alive to the enormous amount of plant capital lying idle due to low power factor.

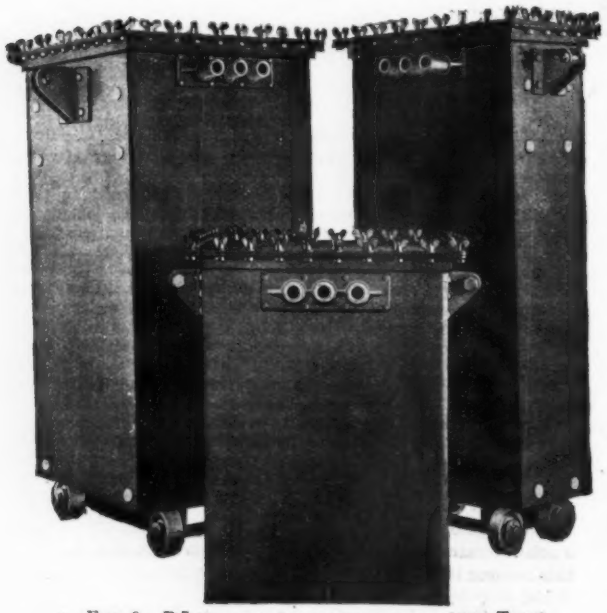

Fig. 8.—B.I. & H. Static Condensers, Tank Type.

The "Helsby" electrostatic condenser, manufactured by Messrs. B.I. & H. Cables, Ltd., is of the Mansbridge self-sealing type, and has many very excellent features, not the least of which is its high efficiency (99·5 per cent.) and low temperature rise (20° F.). Until quite recently the units forming the condenser were built in boxes, and these boxes, in turn, were assembled in a large angle-iron frame, the boxes being filled with insulating oil. A much improved arrangement now supersedes the frame-type, in that units to the number of about 100 are first mounted on a frame, and the requisite number of frames are placed in a sheet-metal tank filled with oil, and in outward appearance similar to a static transformer. The tank condenser represents a step forward, and, like the transformer, needs no elaborate foundation, but only a floor strong enough to bear the weight. Condensers of the tank type are shown in fig. 8.

The highest pressure for which the units of the condenser are designed is 600 volts, so that for higher voltages the requisite number of units are connected in series. There appears to be no practical difficulty in building condensers for 10,000—11,000-volt supplies, but the highest pressure for which the "Helsby" condenser has yet been built is 3,000 volts.

The following are some of the advantages of the static condenser:—

(*a*) Being a stationary apparatus, no attention is required.

(*b*) Maintenance costs are practically nil.

(*c*) The capacity can easily be increased by the addition of further units.

(*d*) The condenser can be connected to any part of the system where power-factor correction is desired.

(*e*) The total capacity required for any particular system, works, &c., can easily be split up into a number of units installed at various points.

The output of the condenser is constant, but if a variable-condenser capacity is necessary, this can be effected by splitting the plant into two sections of one-third and two-thirds the total capacity, and providing a separate switch for each section; by so doing one-third, two-thirds, or the full capacity can be switched on at any time.

It must be remembered that once switched on, the static condenser must take its full load irrespective of the load conditions of the mains, factory, &c. Thus, a condenser taking 100 amperes at zero power factor leading, which normally corrects the equivalent lagging current of the load, will continue to draw this leading current from the mains or generator when the general load is switched off, and for this reason it is often found desirable and, in fact, necessary to switch off the condenser when the load is off. On the other hand, supply undertakings sometimes prefer that the condenser should remain permanently in circuit and correct for other loads on the mains when the particular consumer who installed the condenser has shut down. This overcomes the difficulty of ensuring that the condenser is switched in when the load comes on; otherwise, if charged on K.V.A. demand, the result would be disastrous. There is also one other point that should not be overlooked—namely, that although with the condenser taking a leading current only from the mains (ignoring the efficiency loss), the integrating watt-hour meter should stop, it has been found in one or two cases that the meters reverse. Meter makers will assure you that this will not happen with their particular meter, but "should not" would better meet the case, as it is all a question of correct adjustment when calibrating the meter.

The smaller condensers of about 30 K.V.A. can satisfactorily be switched in with an ordinary oil-switch, provision being made for discharge lamps. For larger condensers it is desirable to have a special oil-switch with charging resistance steps and short-circuiting contacts in the off-position; such a switch should have three overload and no-volt releases.

Reverting to fig. 1, p. 484, it is shown that the current of an A.C. circuit is the vectorial sum of the "watt" and "wattless" components. It follows that if with condenser capacity the equivalent of the "wattless" lagging component be introduced into the circuit, the power factor will be raised to unity. Take, as an example, a load of 100 KW., which at 0·7 power factor has a "wattless" component of 102 K.V.A.; it would be necessary to install a 102-K.V.A. condenser to bring the power factor up to unity.

The capacity required to produce this leading current is calculated from the formula:—

Capacity in mfd. = leading load in K.V.A. $\times$ $10^9/2\pi n \times V^2$,

where n is the frequency, and V the voltage of the circuit.

Assuming 50 cycles and 550 volts, the capacity of the condenser would be—

$$102 \times 10^9/314 \times 550^2 = 1{,}071 \text{ mfd.}$$

This is given by way of an example only; in actual practice it is inadvisable to aim at increasing the power factor above 0·95, as the condenser capacity required above this limit is relatively much greater. This is clearly shown in the curve, fig. 9.

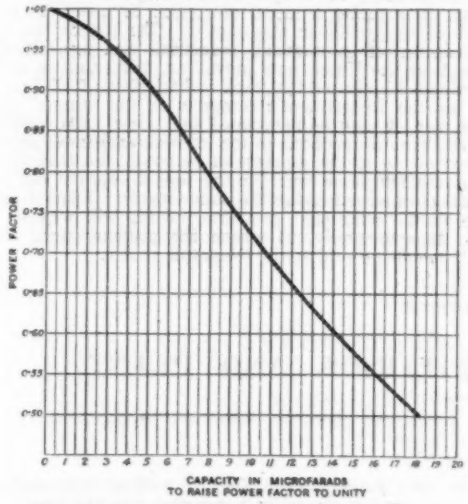

Fig. 9.—Power Factor—Capacity Diagram.

To increase the power factor of a 100-kw. load from 0·9 to unity would require a condenser of 48·4 k.v.a., whereas a condenser of this size would increase the power factor of the same load from 0·72 to 0·9. The capacity of the static condenser is proportional to the load, inversely proportional to the frequency, and inversely proportional to the square of the voltage.

(To be concluded.)

ELECTRICAL TRADE OF SOUTH AFRICA.

Electrical and allied manufacturers will be interested in the following summary of the report on the trade of South Africa drawn up by Mr. J. L. Wilson-Goode (His Majesty's Trade Commissioner at Cape Town), which has just been issued by the Board of Trade.

Projected Public Works. The Department of Posts and Telegraphs of the Union of South Africa is taking the necessary steps to extend and improve the telephone system of the Union. The installation at Johannesburg and also at Cape Town of automatic switchboards of 10,000 connections is projected. The provision of similar switchboards, of a lesser capacity, for use at other centres in the Union is receiving consideration.

The Borough of Durban is negotiating with the Government with regard to the acquisition of a site for a new power station. New machinery is still being installed at the old works, although great delays continue to occur in obtaining plant from the United Kingdom.

The Corporation of Pietermaritzburg has under consideration the question of effecting extensive additions to the electric generating and boiler plant, which have had to be delayed owing to war conditions.

The Municipality of Mossel Bay had practically concluded a contract for the installation of electric lighting plant, and had gone so far as to arrange for a loan, when the war intervened and caused the scheme to be abandoned for the time being. There is now, however, a keen movement in the town and council in favour of reviving the lighting scheme, and the Council is taking steps to have the original plans and specifications brought up to date to meet present-day conditions and requirements, with a view to the scheme being carried out in the near future.

Mining Machinery. The combined efforts of the local manufactories which have sprung into prominence or into existence since the commencement of the war have demonstrated the ability of South African manufacturers to meet the requirements of the mines in a way sufficient, at least, to maintain their operations to the extent of about 80 per cent. to 90 per cent. of their pre-war capacity. But the manufacture of special machinery, such as turbines, steam engines of all kinds, steam hoists, pumps, &c., will in all probability be beyond the reach of the local manufacturing community for a considerable number of years. In point of value the imports into South Africa in 1913 were £765,986, of which the United Kingdom supplied goods to the value of £511,968, and the United States of America to the value of £161,191. German goods were valued at £73,939, and Danish goods at £11,273. In 1918, the total imports were valued at £569,448, and the imports from the United Kingdom were valued at £292,123, from which it will be seen that the United Kingdom supplies were far lower in proportion to the total in 1918 than in 1913. On the other hand, the imports of American machinery in 1918 were valued at £271,730, and, consequently, the proportion of America's contribution to the total imports in 1918 has increased as compared with her proportion to the total in 1913. It must, however, be borne in mind that during the war the facilities for obtaining machinery from the United States of America were considerably greater than in the case of the United Kingdom. The demand for all classes of mining machinery is very great, and it is only by local supplies and by the ingenuity which has been shown by mining engineers in repairing and reconstructing machinery that the inability to obtain an adequate supply of machinery from overseas has not been attended with disastrous results.

So far as Rhodesia is concerned, very little new machinery has been indented, for the mining industry of the country has fallen back on second-hand boilers, engines, crushers, batteries, winding engines, and pumps, of which there has been a large supply, owing to the fact that many mines have become worked out and the plant sold. While several small mines have commenced operations, practically no large ones have commenced crushing, chiefly because no new capital has been obtained from the United Kingdom. It appears, therefore, that, so far as Rhodesia is concerned, new machinery has not been diverted to countries other than the United Kingdom, but that orders have been suspended until they can be executed by United Kingdom manufacturers.

Pumps. The importation of pumps of various descriptions has decreased during the war and the demand, particularly for pumps used in connection with the mines, is very great. In this connection it is well to call attention to the advisability of introducing a British manufactured high-lift centrifugal pump for heads up to 2,000 to 3,000 ft. The bulk of this business is in the hands of foreign manufacturers, notably a large firm of manufacturers in Switzerland. It will be a matter of some difficulty to introduce British competition in this direction, because the pumps supplied by foreign manufacturers have, in most instances, given complete satisfaction. It not infrequently happens that the supply of an important branch of machinery encourages a demand for supplies of other manufactures from the same source. For example, there are many mines in which not only pumps of foreign manufacture have been installed, but also pump-motors and pipe columns.

Electrical Machinery. Although the price of every class of electrical machinery rose beyond all expectations, the value of the imports in 1918 was only £126,323, as compared with £451,280 in 1913, so that the actual quantity imported during 1918 was probably under 20 per cent. of the imports in 1913. The position of the United Kingdom was stronger in comparison in 1918 than in 1913, but it must be taken into consideration that whereas in 1913 the imports from Germany were valued at £252,746 the imports in 1918 had discontinued. The imports from America in 1918 represented about half the total, whereas in 1913 they did not amount to 10 per cent. of the total. In many cases orders for electrical machinery were suspended during the period of the war, and a demand from the United Kingdom can be looked for with confidence.

As to the probable position of United Kingdom manufacturers in the near future, it is thought that every effort will be made by German manufacturers to export to this market either direct or through the medium of neutral countries.

Electrical Materials: Cable and Wire. The total value of the imports in 1913 was £250,669, as compared with £90,624 in 1918. Whilst the imports from the United Kingdom decreased in value from £170,293 in 1913 to £19,744 in 1918, the American imports increased from £4,977 in 1913 to £32,026 in 1918. The most striking feature in connection with the imports of these articles is the extraordinary position of Japanese imports in 1918. During that year the value of Japanese imports was £33,955, which amount is greater than that of any other country, yet it was not until 1917 that Japanese manufacturers introduced their goods into this market when the value of such imports amounted to only £142. In view of the inferior quality of the Japanese supplies and the impossibility of relying upon goods being equal to sample, it is not thought likely that Japan will retain any hold on this market when other countries are free to supply the necessary requirements.

Electric Fittings, Including Posts. In point of value the imports in 1918 were greater than in 1913, the figures being £282,093 and £263,768, respectively, but, having regard to the enormous increase in value of these articles, the quantity imported in 1918 was considerably less than in the comparative year. The value of the imports from the United Kingdom in 1918 was £82,543, as

compared with £154,775 in 1913. The imports from the United States of America in 1918 were valued at £79,233, as compared with £29,578 in 1913. The imports from Japan showed a steady increase until 1918, when they rose in value from £6,052 in the previous year to £24,327. The observations in connection with the prospects of Japanese competition in cable and wire hold true in respect of electrical fittings. The value of the imports from Holland, which in 1913 was £2,901, rose to £24,042 in 1917, and to £94,515 in 1918.

The position during the last few years points to the conclusion that there will be keen competition for the trade which was formerly in the hands of Germany, and it is believed that the United States of America will succeed in capturing a large share of it.

Telegraph and Telephone Materials.

The following figures only apply to the imports of telegraph and telephone material other than that used by the Department of Posts and Telegraphs of the Union of South Africa, and include the importations made on behalf of the Durban Corporation, which controls the telephone system of that town, and the importations by the Eastern and South African Telegraph Co.

The total value of the importations in 1913 was £17,907, of which the United Kingdom contributed £9,866, Sweden £2,765, France £1,711, and the United States of America £1,389. The importations in 1918 were valued at £5,997, of which Sweden contributed £2,500, the United Kingdom £2,238, and the United States of America £1,214.

So far as Government requirements are concerned, the importations from countries other than the United Kingdom during the period of the war have been negligible, and are represented by copper wire to the value of £3,864 from Japan, and telephone instruments valued at £4,062 from the United States of America.

There is no likelihood of enhanced prices reducing the future demands of the Department of Posts and Telegraphs. As the Department has the exclusive privilege of constructing and maintaining the telegraph and telephone systems of the Union, it is under a moral obligation to meet the requirements of the public in this regard. The marked activity in all branches of commercial, industrial, and agricultural life throughout the Union now prevailing, will result in demands for extended improved telegraph and telephone facilities, which will tax the Department's resources to the utmost. In this connection, it may be mentioned that some 1,600 applications for telephone connections to the existing exchanges have been refused owing to the shortage of material, and that 700 miles of private telephone wire for the use of country residents is awaiting construction for the same reason. Apart from this there is the additional provision, which will require to be made departmentally, to relieve the pressure upon existing trunk telephone and main telegraph routes.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Martin Rotary Converter.

There are a number of purposes for which D.C. is essential, such as for battery charging, kinematograph arc lamps, and so on, and in such cases, if the supply is alternating, some means of transformation must be provided; consequently, an improved machine for the purpose should be welcome. The "Martin" patent synchronous rotary converter is such a

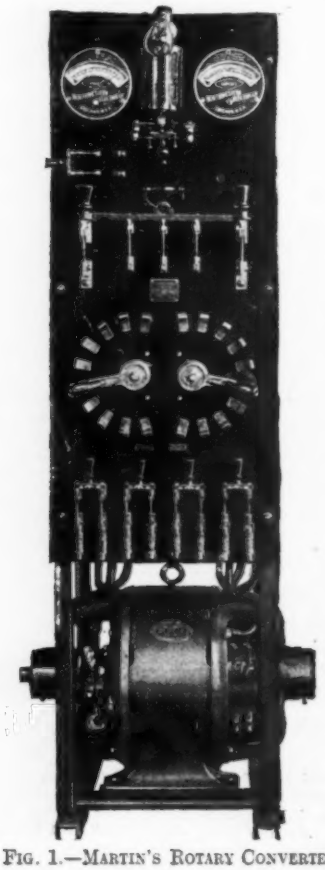

Fig. 1.—Martin's Rotary Converter.

machine; it requires no special starting apparatus, but is self-starting, and self-synchronising; its efficiency is claimed to be considerably higher than that of a motor generator, whilst it has a power factor of practically unity, making it a very desirable machine from the supply-station engineer's point of view. The transformer which supplies the rotary can be used for regulating the D.C. voltage, thus eliminating the loss entailed by using resistances for the purpose, and in the case of kinema projection work, it can also be used to give a standby supply in case of emergency. The illustration (fig. 1) shows one of these converters with a control panel arranged for battery charging. The converter is mounted in the base of the panel, making one self-contained unit. These converters have been standardised in sizes from 250 watts to 5 KW., single-phase, and from 250 watts to 50 KW. polyphase, for any frequency from 25 to 60 cycles, and for any required D.C. voltage from 25 to 250 volts. They are supplied by the Electrical Engineering and Equipment Co., Ltd., Bank Buildings, 109-111, New Oxford Street, W.C. 1.

A New Tramway Life-guard Tray.

Our illustration, fig. 2, for which we are indebted to Mr. J. E. Stewart, engineer and manager, Llanelly and District Electric Lighting and Traction Co., shows a new tramway life-guard tray, which has been in operation for some time past at Llanelly, and which has proved satisfactory. The

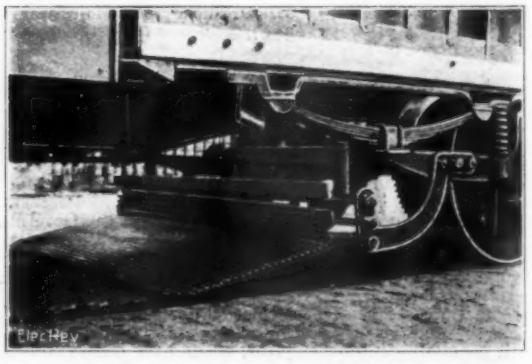

Fig. 2.—A New Life-guard Tray.

tray is composed of corrugated iron riveted or bolted to any type of frame, and does away with the usual wooden slats used for this purpose, which are a continuous source of trouble and expense, as the slightest trouble means the breaking of the wooden slats. In the figure another modification is shown which has been found to reduce cost; in lieu of the usual cast-iron brackets which carry the pilot board, a wrought-iron bracket has been substituted as shown, and in place of the wooden pilot board itself three rods are used. In the case of fouling anything on the road, these bend out of shape, whereas previously the old bolster, or both bolster and bracket, were broken, with consequent delay and expense of removing the débris, but it is quite a simple matter to replace the bent rods, which remain as good as ever. This life-guard tray is made by the Gorse Galvanising Co., Ltd., of Dafen, Llanelly.

A New Electric Hand Lamp.

The Elektrische Spezialfabrik für Kleinbeleuchtung, Berlin-Schöneberg, has produced a novel electric hand-lamp, called the "Eltra-Lamp," which is cheaper to run than lamps fitted with dry cells or accumulators. The source of current is a cell with lead superoxide and zinc plates immersed in sulphuric acid, which combination gives 2.45 to 2.5 volts. The body of the lamp is supported on a trunnion so that it can be tipped through 90 deg. In the position of rest the liquid lies in a protruding chamber, the plates being thus lifted out of the electrolyte. When the lamp is required for use the body is tilted so that the liquid flows back and immerses the plates. When the lead plate is discharged it is replaced by a charged one, which may be kept ready charged in store for a lengthy period. The charging of these plates is carried out very cheaply at depôts. They will give 25 hours' burning with one charge, and can be charged 100 to 150 times.—*Technical Review.*

Light-Load Running Device for Semi-Diesel Engines.

When a semi-Diesel crude-oil engine is run on light load, it consumes an extremely small quantity of fuel, and the heat produced is inadequate to vaporise the fuel oil for the succeeding injections and to give complete combustion. Messrs. Vickers-Petters, Ltd., we are informed, have achieved a satisfactory solution, which completely eliminates all troubles of this kind, and, in addition, enables the engine to run at slow speed with perfect combustion and regularity of ignition. With the Petter patent light running device means are provided for giving a supplemental injection which is forced into the combustion chamber earlier than the normal injection. This is effected by giving an extra stroke to the fuel pump on single-cylinder engines, and on multi-cylinder engines a device is fitted whereby any fuel pump may be made to deliver fuel to two cylinders at each stroke, one portion of the charge being injected into the cylinder normally supplied and at the correct timing, and the other portion is injected in advance of the normal timing. In this way each cylinder is supplied with an advanced injection.

The earlier injection of the light charges gives more time for the vaporisation of the fuel oil and maintains sufficient heat in the combustion chamber to produce perfect combustion, and the engine will continue to run at no load firing regularly without the aid of the starting lamp. The device also enables the engine to be run at low speed with the same result. The device is operated by hand instantaneously; it is a standard portion of the equipment of all semi-Diesel crude-oil engines for land and marine purposes manufactured by Messrs. Vickers-Petters, Ltd., of 73, Queen Victoria Street, London, E.C. 4, at their Ipswich works.

INTER-IMPERIAL COMMUNICATION.

By Sir CHARLES BRIGHT, F.R.S.E., M.Inst.C.E.

(*Abstract of paper read before the* British Association, *Section F.*)

The long-standing national need for a modern high-speed British trans-Atlantic cable has now become more than ever accentuated. The author has for long advocated it, but it also formed one of the Imperial War Cabinet's recommendations. Further, it has been urged by each of the Dominion Governments, as well as by the Empire Press Union and the principal Chambers of Commerce. Though it is true that H.M. Post Office is now working what was once a German Atlantic cable, this line has been for long periods out of operation, and is, at its best, an ancient and poor working affair. But from an Australasian standpoint, it would be worse than futile to provide a new link without first duplicating the deepest section, at any rate, of the All-British Pacific Cable, seeing that the latter is now greatly over-congested with traffic. It is this section that keeps the speed so low on the whole system, but by means of the duplication here urged a greatly improved position would accrue. The rest of the line would also require to be dealt with similarly in due course; and to effect really satisfactory communication between the Mother Country and Australasia, the Pacific Cable Board should be enabled to work direct from London to Melbourne via (1) the above-suggested All-British Atlantic Cable, (2) a new independent (underground) land-line connection between Halifax or Montreal and Vancouver, and (3) the duplicated Pacific cable.

Another greatly needed connection is a cable between Barbados and Bathurst. Had such a line existed during the war it would have relieved the ordinary "Eastern" route of a great deal of its congestion. A further cable between Bathurst and Gibraltar would also serve to complete a fresh "All-British" link with the Cape.

The eventual realisation of these connections—together with the active development of wireless links—would do much to improve the political and trade relations of the Empire.

Whilst we have *talked* of "All-British cables for many years, our American cousins have, of late, shown a strong inclination not only to talk "All America" but to establish links going by that name. Their ultimate aim is apparently to embrace the whole of the North, Central and South American Continent—telegraphically speaking—with a view to vast development in American trade generally as well as for fostering friendly relations between the Republics involved. The United States Government is evidently fully alive to the strategic and commercial importance of American-owned and American-controlled cables run on a low rate basis.

It clearly behoves us, as a country, to do all that is reasonably possible towards developing inter-Imperial telegraphic communication on a broad and economic basis, and in general national interests—not merely for overcoming the existing telegraphic congestion, but quite equally for high political, defence and trade reasons.

There is to-day little to choose between the working speed obtainable through a cable and that, under the same conditions, by "wireless" of a correspondingly up-to-date character. Even now, however, the cable appears, for one reason or another, to be most favoured for extended commercial purposes. But so far-reaching and important have been the technical developments of this (wireless) method of communication since hostilities commenced that it behoves us to endeavour to turn it to something like the same account between distant lands as has already been done for marine purposes.

The author would like to see (1) the All-British wireless chain put into effect without much further delay, (2) every inter-Imperial cable connection supplemented by "wireless," and (3) a highly developed wireless news service established for the prompt and synchronous dissemination of news betwixt all branches of the Empire, this being a field for which "wireless" is especially well adapted.

Owing, however, to the vastly increased call for inter-Imperial communication that may reasonably be expected, it is conceivable that the increased facilities by cable and wireless might yet not be sufficient to cope with requirements. For this reason, as well as on general utilisation grounds, the author especially advocates the application of a system of message rationing, by means of which each word in a message is turned to the fullest possible account—if possible of a more scientific and efficient order than any existing code. The author has always argued that a great national and Imperial benefit would be conferred—largely in the interests of trade—if a really low flat rate, common to the whole Empire, came into force on any All-Red cable and wireless system. But it must not be forgotten that an essential accompaniment to a low telegraph tariff is many more communicating strings; otherwise the congested condition would only become worse congested.

With the prevailing high rates, accompanied by the still existing congestion, it is impossible for the Press of the Empire to do a tithe of what it might do in the service of the nation and Empire, either in a political or trade sense.

By far the greater proportion of the cable doing service at the bottom of the sea is the result of British private enterprise, to which much credit is due for the excellence of the service provided. The projectors of the original lines stood in the position of commercial pioneers, and their successors have upheld a great tradition. It remains to be said that the companies concerned have, quite rightly, already benefited by rich returns, besides obtaining handsome subsidies from the State.

On the other hand, those acting on behalf of the State appear to have greatly lacked in securing an adequate return in the nation's interests when drawing up agreements with the companies. So far, landing rights seem to be the only ordinary lever for negotiation, and but little advantage has been taken even of this lever on behalf of the country. Moreover, it is fairly clear that an altogether insufficiently wide Imperial view of telegraphic communication has as yet been taken by the responsible Government officials.

The question is whether telegraphic links are not intended to serve a wider and grander use to the community than the building-up of dividends. If the answer is in the affirmative, this raises another question—*i.e.*, whether inter-Imperial communication should not be put on the same footing as the Navy, Army and Air Force—forming as it does one of the most important strategic weapons. If that is admitted, then surely it would be far more suitably charged proportionately on the estimates of these three defence departments—and possibly also of others—than several items which are now a subject of public taxation.

We have, too, to ask ourselves (1) whether inter-Imperial trade cannot be greatly assisted by a considerable reduction in the Imperial telegraph rates, and, if so, (2) whether this object should not come before any vested interests where the

two run counter? Is the nation to be sacrificed to vested interests, or is the nation to prevail where public and private interests do not coincide? It is obvious that they do not coincide, seeing that (*a*) the rates to outlying branches of the Empire at present bear some sort of proportion to distance, (*b*) the rates to some foreign countries are distinctly more favourable than to certain portions of the Empire.

It is necessary primarily to regard telegraphic communication from the standpoint of what it can achieve for the country and Empire in the matter of security and trade development, rather than mainly as a dividend-earning concern. It should be remembered, too, in this connection that Empire trade is dependent on Empire security.

What has been implied above points to either (*a*) the ownership or purchase by the State of at least one main trunk of inter-Imperial cables, supplemented by the aforesaid wireless chain, both being run at a quite low, common, Imperial rate, or alternatively to (*b*) substantial subsidies being paid to those cable companies whose rebates have so far not only been too tardy but too insufficient in character to be of any great value to the nation.

It appears to the author that many people generalise too much against nationalisation on principle. One of the most popular stock arguments against nationalisation is that every business that has been touched by Government departments has always been unsatisfactorily "run" as compared with similar efforts by private enterprise. Surely, however, all that that really points to is that Government offices are not worked on business principles by business men. That state of things would require to be entirely changed.

Whether State ownership should ever be applied is, of course, a big question, but in any case it will surely be obvious—in view of what has been said—that in national and Imperial interests some sort of State control is desirable in the matter of inter-Imperial communications generally. A controlling organisation of some sort seems to be called for, if only for watching and securing public interests, where clashing with private interests, in return for favours granted by the State.

The author has for some 17 years advocated an Inter-Departmental Board to deal with inter-Imperial telegraphy of all sorts. By this scheme all the Government Departments concerned were to be represented and meet periodically to discuss and settle all important matters as they arose.

The war made it clear to the Government that something of the sort was necessary; and the beginning of the present year saw the establishment of the Board here described, with a highly satisfactory chairman in Lord Milner—the whole coming under the ægis of the Committee for Imperial Defence.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North-Eastern Centre.

The first meeting of the 1919-20 session of the North-eastern Centre of the I.E.E. was held at Newcastle-upon-Tyne on October 20th. Mr. A. P. Pyne, the retiring chairman, presided, and in welcoming Mr. W. Cross to the chair, said that that gentleman came at an important moment, when all sorts of schemes were in the air for reconstruction. They wanted to help on all enterprise, and if only men would sink their differences, work for the common good, and get the maximum output, there was hope. He was not a pessimist, but he found that while in certain industries the Germans were not doing better than they were here, in other industries Germany was getting ahead. They were working with a tenacity of purpose that was unknown here, and which would enable them to enjoy the position they had before the war.

Mr. W. Cross, having taken the chair, delivered his address upon "Some Notes upon the Installation and Maintenance of Electrical Apparatus." He said: The efficient installation of electrical apparatus depended chiefly on attention to detail, and the aim of those carrying out such work should be to obtain: (1) Reliability, for the resultant cost of a breakdown might be many times the cost of the faulty apparatus; (2) low first cost, which was especially required to-day, and should always be kept in view, as the more expensive material was by no means the most suitable in every case; (3) ease of maintenance and repair; not only because this cost should be as small as possible, but because time was usually of great importance. Many sets of rules had been drafted for installation work, but many of them were not clear, and contradicted one another; in most cases they were not enforced and observed fully. He thought one set of rules should be drawn up, stating certain broad principles, and should be observed in all cases. Those rules should call for the minimum requirements to ensure reasonable safety instead of insisting upon the use of the most expensive apparatus as occurred in some cases at present The lay-out of an installation was most important, and should be arranged with a view to any likely extensions, as well as the immediate work in hand, by which means expense might be saved in the future. The number of fuses, switches, and other controls, should be reduced to a minimum, as each joint, or piece of apparatus, was a possible source of breakdown. Almost invariably the distribution-board system of wiring was best. He considered all two-wire circuits, except on concentric systems, should be protected on both poles, even if one pole were connected with the middle wire of a D.C. three-wire system, or to the neutral of a three-phase system, as by that means testing and disconnection were facilitated. It was worth taking trouble to see that the controlling apparatus was arranged most conveniently for the user. Regarding systems of factory lighting, it would generally be found that general rather than local lighting would give the best results, as it enabled work to be carried out in any part of the room without altering the position of the lamps. In engineering shops and similar buildings, if efficient reflectors were used, about 3 candle-ft. gave a good illumination, and in offices about 4 candle-ft. was required. The number and size of lamps would depend upon architectural features. In many cases it was most economical to use high C.P., half-watt lamps. He was unable to discover a satisfactory specification for cable which would reject poor quality, and pass cable of a good lasting quality, and he found it necessary to trust almost entirely to the reputation of the makers. They had had more trouble with cable made to a stringent Government specification than with a much cheaper cable by an old-established firm. He could remember few instances of true cable breakdowns. In most cases the faults arose from mechanical or chemical external injury. To obtain the greatest economy, the size of cable should be calculated by Kelvin's law, which stated that the loss of energy in the line should equal the interest on cost and depreciation of the line, but the satisfactory working of apparatus, and the need of standardising the voltage (all same volts) prevented this law being observed in most cases of internal tubing. The I.E.E. Rule (40) did not specify any voltage drop. Paper insulated cable could safely carry more current than V.I.R. cable of the same size. Owing to the reduced carrying capacity of large cables, it was sometimes cheaper to use two or more cables instead of one, but each case must be considered on its merits. For V.I.R. cables he found supporting on porcelain insulators, with tubing where subject to mechanical injury, was the most satisfactory method (apart from its low cost) in engineering shops, but was not suitable for houses, offices, or similarly constructed buildings. The metal covered system he had not found satisfactory for 240-volt D.C., probably through the bad earthing of the covering. He thought the methods of bonding might be improved, and that a conduit box with cone nipple and lead wool for bonding the metal covering to the box, would be satisfactory. Wood casing made a sound job when the situation was dry and free from chemicals, but it required more labour. With wood casing it was safer to have cables of differing polarity in the same groove, as a fault then would blow the fuse more quickly. With close joint tubing very few faults had occurred; screwed tubing where insulators were unsuitable, was the best system to use, although the cost was great. The method of leading cables into apparatus and connecting up deserved more attention than was usual. The arrangement of leading-in cables, connecting up, and fault finding for motors was badly designed. A terminal plate should be provided to which all connections of field coils, armatures, rotors, and stators, should be brought. All terminals should be marked in a standard method. Earthing in factories should receive more attention than was usually the case. Bolts and nuts were not efficient, their resistance being high. In conclusion, he urged that the rating of apparatus should receive more attention, and instanced switches, few of which would break properly the current for which they were rated, for 100 times. It was also very desirable that material should be standardised, which would eliminate one of the principal troubles of maintenance. Maintenance was often neglected, and it was surprising that more accidents did not occur. Labour was one of the most important factors in an efficient installation. He would rather have poor material and good labour, than good material and bad labour.

Discussion.

Mr. A. P. Pyne agreed with Mr. Cross's conclusions. It did not seem possible to draw up a specification for cables that could not be got over by the makers. The oil switch difficulty was an old one; he had seen a battery of switches which could not be connected until they had been altered by the erectors. The bell test for earthing answered reasonably well, and he did not know a better one. He emphasised the chairman's remarks as to the inefficiency of workmanship; one "electrician" he had employed did not know what a distribution box was.

Mr. Carter said that the protection of neutral wires was important; while he agreed that it was better to protect, it must be very carefully done. While it was quite true that they wanted to keep the first cost of installations low, they should define the word "low" very carefully. He had heard of a case where a contractor was 50 per cent. above the next tenderer, and 100 per cent. above the lowest, and his tender was accepted without the slightest hesitation because of the character of his work. He thought if the principal draughtsmen were allowed occasionally to go out and see the work that was going on, it would tend to improve the standard of the work.

Mr. Pinkney agreed that it was probably better to have good workmanship and inferior material than the reverse. He really thought that the greatest difficulty was in getting

adequate supervision. It was extremely difficult to get workmen who were anxious to do a craftsman's job. They seemed to aim at doing as little as possible, and getting as much as possible, therefore, there was much greater need for supervision than in the past. Would it not be possible, he asked, for the Contractors' Associations to arrange for joint supervision, so that a job might be supervised as many hours as it was minutes now?

Mr. H. W. Clothier said one of the great troubles was that of protection. He believed that in the course of time this would be eliminated by having every conductor completely metal clad. To his mind it seemed that anything but a complete metal-clad system was only of a temporary character.

INDUSTRIAL POISONING.

In the annual report for 1918, of H.M. Chief Inspector of Factories and Workshops, the opportunity is taken by Dr. T. M. Legge of reviewing briefly the incidence of poisoning and industrial disease during the last four years. In what follows the principal numbers relate to cases, the smaller figures to deaths. The reported cases of lead poisoning are given as follows: 1918, 144[11]; 1917, 317[21]; 1916, 348[21]; 1915, 381[21]; 1906-8, 619[3]; 1900, 1,058[5]; the electric accumulator industry being placed thirteenth in the list with the following number of cases: 1918, 16; 1917, 27[1]; 1916, 44[1]; 1915, 64; 1906-8, 24; 1900, 33. Lead usually takes months or years to show its effects, and there has been no increase in the number of women reported as suffering. Figures for certain trades show marked diminution, no doubt due to the cessation of work during the war. The manufacture of accumulators for submarines and other purposes during the war was carried on at very high pressure, and accounts for the high figure reached in 1915. In this industry there is perhaps more handling than in any other, and to ensure safety meticulous attention to detail in exhaust ventilation applied to the many points at which dust can arise, is necessary. Study of the movements of the worker, with the object of simplifying the way in which the dangerous processes are carried on, would tend to increase the margin of safety. Sustained effort will be required to prevent as far as possible the cases of lead poisoning from increasing again in peace time. Little more is to be learned as to how lead poisoning is caused, and it can be taken as axiomatic that all risk lies in inhalation of dust and fume. These removed or prevented there will be no lead poisoning.

In summarising 1,208 cases of mercurial poisoning between May, 1899, and December last, the electric meter industry occupies fourth place in the list with 24 cases, and the mercury lamp trade ninth with three cases. A committee of employers is now going fully into the question of improving the conditions. Three unusual cases occurred in rubbing a mixture of tin and mercury on tins. The latter were afterwards brushed, and it was in inhaling the dust while brushing that the danger arose.

Of the total cases of power gas poisoning in two years, three were due to feeding operations and 16 to cleaning and repairing. Three occurred to men some distance away on to whom the fumes were blown. Mr. Shuter (Leeds) gives an account of one case showing the danger from underground flues: Two women who remained in an office all night were both found dead in the morning. The nearest flue was 30 ft. away, but on old disused flue was discovered only 6 ft. away; this was connected with the flue in use, but had been bricked off, and formed a *cul de sac*; the conclusion come to was that some gas percolated through the bricks and found its way into the office. In another case at least twelve persons were somewhat seriously affected by gas from a subterranean fire. It appears that a duct from a blower, made of brick, leaked, allowing the blast to penetrate to the subterranean fire, so keeping it up. The gas presumably had generally escaped by surface cracks, but as the ground at the time was frozen it found a way of escape through the floor of the workrooms. The certifying surgeon reported that the worst cases complained of icy coldness of the feet, intense headache and giddiness. In one case a radiant heat apparatus was necessary to restore circulation to the extremities.

In January, 1918, two fatal cases of purpura hæmorrhajica were reported from Edinburgh. The illness affected two men employed as rubber spreaders, and these are the first cases of chronic benzol poisoning known to have occurred in this country. The rubber was dissolved in benzene (crystallisable benzol), the solvent previously used having been coal-tar naphtha. Approximately three months elapsed between the commencement of intoxication and the onset of acute symptoms. The history of these cases was practically identical, both were young and apparently healthy men. In July, 1918, a third fatal case was reported; in this case benzene was used as a solvent, and it is a case in point showing the adverse effect of accidentally diminishing ventilation where fumes from benzene or similar bodies are given off. In view of the dangers disclosed the alternatives are either to stop the use of benzol or to increase the ventilation. Alternatives to benzol have been considered, and it appears that xylol compound can be used as a rubber solvent with, at any rate, very much less danger than benzene.

Dr. Bridge investigated the condition known as oil dermatitis, which proved very troublesome in engineering works during the war, arising from cutting oils and compounds, and soluble oils used on automatic lathes and similar machines. He describes the affections of the skin as due to the blocking of the hair follicles and ducts of the sebaceous glands by a paste of oil and dirt.

Injury to the skin is the primary factor in the production of septic infection, and as lubricating fluids contain sharp particles in suspension, mere movement of the fingers or leaning the arms on the work may produce sufficient injury to the skin to cause the primary lesion, through which the germ enters. For prevention, cleanliness of the workers' hands and arms, and the removal of the oil and dirt, unavoidably present, is essential. Dr. Bridge describes as having proved satisfactory, not only in prevention, but also in curing the condition, washing with ether soap, and powdering the arms before and after work with equal parts of zinc oxide and starch.

RAILWAY ELECTRIFICATION IN SOUTH AFRICA.

The advantages of the electrification of certain sections of the South African railways are set forth in considerable detail in a report by Messrs. Merz & McLellan, which was published recently. The sections considered are confined to four divisions. The first comprises the main line from Capetown to Touws River and suburban lines in the Peninsula. An estimated return on the net capital outlay of 12.1 on the main line section, 10 per cent. on the Simonstown branch, 8.1 on the Sea Point line, 80.5 on the Docks branch, and 9.7 in the Docks area is expected. The second section comprises the Natal main line from Durban to Glencoe, whereon a return of 40.3 per cent. is anticipated, and the Glencoe Vryheid East branch, with a return of 12.5 per cent. The third section is the Witbank-Germiston-Randfontein line, where the return is estimated at 10.8 per cent., while the fourth section is the Delagoa Bay line between Witbank and Komati Poort, and here the return is expected to be 5.6 per cent. Thus the conversion of the main line in Natal is by far the most profitable. The introduction of electric traction would avert the necessity for doubling the line, traffic on which is approaching the limit of capacity for a single track. A number of advantages to be derived from the conversion are enumerated. As it is out of the question to take in hand simultaneously the whole scheme of electrification, the report recommends steps for the conversion of the line between Durban and Glencoe to be put in hand immediately, then successively the Rand line, Vryheid East, branch Cape lines, and finally, that the Witbank-Komati Poort section should be electrified. The report goes into the comparative merits for the electrification by the D.C., single-phase, and three-phase systems. It expresses the opinion that the D.C. system is the best adapted to the general requirements in South Africa, and recommends its adoption. The narrowness of the gauge to some extent restricts the use of high-voltage motors, but the report states that investigators have come to the conclusion that it is practicable and desirable that the average voltage of supply to trains should be three thousand. It is recommended that the overhead system of transmission should be adopted. For main line traffic it is proposed to use goods locomotives with tractive effort of 48,000 lb., compared with 53,750 lb. of the present Mallet articulated type, and passenger locomotives with tractive effort of about 30,000 lb., which would be capable of hauling a 600-ton load up a gradient of one in sixty. It is proposed to increase very substantially the general speed of goods traffic. Provision will be made for a speed of 20 to 23 M.P.H. up ruling gradients by goods trains, and 28 to 29 M.P.H. for passenger trains, while for level parts provision will be made for an express passenger locomotive to haul 15 main-line coaches at not less than 55 M.P.H. For suburban services, trains will be made up on the multiple unit system, each unit consisting of motor and trailing coaches. In this way during rush hours trains will be composed of four or five units (eight or ten coaches), while at other times two units might suffice. One feature of electrical working in South Africa is that trains running down long gradients would make use of regenerative breaking. Comparison is made with the test made with a locomotive of the 12th class, with a load of about 1,200 tons, on a run from Witbank to Germiston, which covered the distance in 3 hours 45 minutes, exclusive of stops, whereas an electric locomotive would take 2 hours 30 minutes. If it should be decided to electrify the line through from Capetown to Johannesburg, it is not thought that there will be any difficulty in covering the whole distance in 24 hours. There is no reason to anticipate that electrification will give rise to any increase in receipts, but the reduction in working expenses will be very considerable. Improvement in the suburban passenger service will consist in speeding up the service, and in providing more trains to accommodate additional passengers. A further portion

of the report deals with the supply of power for the electrification, and is full and detailed. It takes into account the possibility of electrification being extended beyond the sections already mentioned, and of energy being generated for other than railway purposes. The report does not anticipate any substantial gain from the utilisation of water power for the generation of energy. It suggests for Natal lines the erection of power stations at Durban and Tayside, near Glencoe. For the Rand line, power might be taken partly from a station on the Great Olifant's river and partly from the existing network of the Victoria Falls Co. For the eastern line a power station should be provided at Komati Poort, and for lines radiating from Capetown there should be a power station near Capetown and another at Touws River. At Capetown a combined station is suggested as capable of developing power for railways, tramways, and municipal requirements. In a detailed consideration of various sections, the report deals with acceleration and provision to be made for new rolling stock, the number of locomotives set free for use elsewhere, &c. It anticipates an increased average speed of about 25 per cent. on suburban lines in the Peninsula, and provision is made for increasing train miles from 623,000 per annum to 766,000, while on the Randfontein-Springs section the increased speed would vary from 16 per cent. between Johannesburg and Germiston to 84 per cent. for trains for the whole distance between Randfontein and Benoni. The proposed new service provides for an increase of 66 per cent. in train mileage on an ordinary week-day. There are a number of statistical tables attached to the report.—*S.A. Mining and Engineering Journal.*

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

24,950. "Starting electric generator plants driven by internal-combustion engines, &c." I. B. Blaiberg. October 13th.
24,961. "Electrically-operated hoisting devices." P. Speck. October 13th.
24,975. "Electric accumulators." F. C. Stockel. October 13th.
24,985. "Visual and audible electric indicators." J. G. Rose. October 13th.
24,995. "Combination short circuiting switch for motor cars, &c." F. Crew, F. Peart, and A. H. Ruddle. October 13th.
25,022. "Means for attaching magnetos, dynamos, &c., to motors, &c." F. W. Berwick & Co. and M. H. L. Sizaire. October 13th.
25,033. "Sparking plugs." J. Hanman. October 13th.
25,039. "Wireless telegraphy, &c." S. Brydon and S. Johnson. October 13th.
25,052. "Electric furnaces" M. R. Trembour. October 13th. (United States, March 24th, 1916.)
25,053. "Electric commutating or switching." W. A. Price. October 13th.
25,065. "Electric tramcar pole end." S. D. Master. October 13th.
25,068. "Electric switches." C. G. Bennett and H. Garde. October 13th.
25,085. "Electric heating apparatus." B. Thomas and E. Thomas. October 14th.
25,088. "Continuity electricity conductors." J. W. Astley and British Insulated & Helsby Cables, Ltd. October 14th.
25,108. "Electric switches, isolating links, &c." R. T. Norton. October 14th.
25,120. "High- and low-tension distributor of electricity for ignition in motor engines." T. W. Cheetham. October 14th.
25,124. "Ignition devices of internal-combustion engines." J. White. October 14th.
25,134. "Sparking plugs." G. E. Parker. October 14th.
25,136. "Electric signal systems." A. J. Joyce. October 14th.
25,160. "Machine switching telephone exchange systems." L. Polinkowsky and Western Electric Co. October 14th.
25,163. "Electro-medical apparatus." C. Klein. October 14th.
25,172. "Electric contact maker for railways." N. P. Roe. October 14th.
25,173. "Railway block section detector." N. P. Roe. October 14th.
25,176. "Pneumatically-operated controllers for electric motors. British Thomson-Houston Co. (General Electric Co.) October 14th.
25,177. "Electrically-driven planers, &c." Metropolitan-Vickers Electrical Co. and L. Miller. October 14th.
25,182. "Electrodes, welding rods, and soldering sticks." E. H. Jones. October 14th.
25,227. "Thermo-electric system and means for producing electrical energy." E. B. Potter. October 15th
25,230. "Magneto hand lamps." A. E. Angold and A. H. Railing. October 15th.
25,245. "Interlinking electric power stations." A. M. Taylor. October 15th.
25,271. "Apparatus for transmitting and receiving electric oscillations." A. E. J. Vlug. October 15th. (Germany, August 19th.)
25,285. "Electric pocket lamps." C. Boltshauser and Cosmophos Werke Akt. Ges. October 15th.
25,286. "Sparking plugs." A. Sproul. October 15th.
25,290. "Electric ignition plug." Delta Co. October 15th. (Switzerland, April 29th.)
25,302. "Electric push button switches." A. Cesaro. October 15th. (Italy, February 8th.)
25,307. "Bar windings for electric machines." H. Roos. October 15th. (Germany, May 4th, 1918.)
25,356. "Electrical earthing devices." R. S. Woods. October 16th.
25,369. "Telegraph printing systems." Automatic Telephone Manufacturing Co. and S. R. Smith. October 16th.
25,381. "Device for cleaning sparking plugs." C. Ketterer. October 16th. (France, June 13th.)
25,386. "Conduits for electric wires or conductors." J. Hall-Edwards. October 16th.
25,403. "Radio-signalling systems." E. F. W. Alexanderson. October 16th. (United States, October 16th, 1918.)
25,416. "Electrically-insulating rail joints." W. R. Sykes Interlocking Signal Co. and B. R. Wills. October 16th.
25,417. "Insulating material for electrical purposes." W. R. Sykes Interlocking Signal Co. and B. R. Wills. October 16th.
25,419. "Electrodes for secondary batteries." T. D. Greenley and Vickers, Ltd. October 16th.
25,420. "Dynamo electric machines." A. Courtiade. October 16th. (France, July 18th, 1916.)
25,426. "Electrical petrol vaporizer for carburettors." H. D. Galvin. October 16th.
25,434. "Incandescent electric lamps for automobiles, &c." Butlers, Ltd., and A. Reeves. October 17th.
25,435. "Renewals of filaments in metal-filament electric lamps." S. Coxon and W. A. William. October 17th.
25,440. "Electric clocks." A. E. J. Ball and I. H. Parsons. October 17th.
25,456. "Electrical distribution in alternating current system." A. M. Taylor. October 17th.
25,466. "Jointing metallic sheathed electric cables." Callender's Cable & Construction Co. and A. E. Wilson. October 17th.
25,467. "Spring contacts for electric switch of switch fuse handles." Callender's Cable & Construction Co. and F. Moor. October 17th.
25,474. "Electrical indicating apparatus for transmission of orders, &c." F. R. Horley and J. G. Hooper. October 17th.
25,475. "Electrical hot plates, &c." G. P. Cosway. October 17th.
25,485. "Balancing means for polyphase electric current systems." Metropolitan-Vickers Electric Co. October 17th. (United States, October 17th, 1918.)
25,487. "Insulation and protection of live electric rails and gutters, &c." R. Attwater. October 17th.
25,497. "Process for production of zinc battery elements." S. O. Cowper-Coles. October 17th.
25,505. "Paste for storage battery plates," T. A. Willard. October 17th.
25,509. "Electrical commutators." R. S. Dahl. October 17th. (Denmark, October 16th, 1918.)
25,518. "Dynamo-electric machines." Baron Clifford of Chudleigh. (W. H. Clifford.) October 17th.
25,553. "Metal electrodes for welding or deposition of metals." E. A. Atkins and Rylands Bros. October 18th.
25,558. "Electric furnaces." J. Harrison. October 18th.
25,559. "Dynamo-electric machines." G. Schroeder. October 18th.
25,560. "Electro-magnetic mechanisms for telegraphic purposes." Automatic Telephone Manufacturing Co. and S. R. Smith. October 18th.
25,563. "Electric hand lamps." T. W. Rhind and Rhind & Co. October 18th.
25,566. "Electric light wiring systems." R. S. Woods. October 18th.
25,581. "Electric motors." G. D. Mann and W. Purden. October 18th.
25,598. "Magneto-electric machines." M. M. Cardellino. October 18th.
25,609. "Stampings for electric machines." A. W. Tomkins. October 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

17,011. Electric signalling apparatus. F. S. S. Wates. November 17th, 1917. (132,818.)

1918.

7,718. High-frequency dynamo-electric machines with turbine drive. Allgemeine Elektricitats-Ges. January 24th, 1917. (116,088.)
13,521. Ignition devices. E. C. R. Marks. (Splidorf Electric Co.) August 20th, 1918. (132,840.)
15,592. Alternating electric current machines. British Thomson-Houston Co. (General Electric Co.) September 25th, 1918. (132,876.)
15,600. Electric furnaces. E. L. Crosby. September 25th, 1918. (132,879.)
16,337. Electric signalling systems, such as are used in mines. Automatic Telephone Manufacturing Co. and C. Remington. October 8th, 1918. (132,903.)
16,659. Protective arrangements for electric distributing cables and the like. Electric Improvements, Ltd., and J. R. Beard. October 12th, 1918. (132,909.)
18,425. Spring contact clips for replacement electric fuses. J. H. Collie. November 11th, 1918. (132,928.)
18,928. Electric switches. A. H. Railing, C. C. Garrard, and A. F. Searle. November 19th, 1918. (132,936.)
21,105. Electrical means for locating masses of metal. J. Neale. December 18th, 1918. (132,956.)

1919.

10,870. Presses for assembling the parts of sparking plugs. A. Lyonnet. May 1st, 1919. (132,994.)
12,700. Electric supply systems for use on ships. O. E. Jorgensen. May 20th, 1919. (133,002.)
13,451. Contact pins for electric connecting plugs. O. Stalhane and O. O. Kring. June 19th, 1919. (133,010.)

Electricity from the Wind.—During the coal famine caused by the war many attempts were made in America to improve the working of the windmills geared to dynamos to generate electricity. About 250 installations on farms and small estates have proved fairly satisfactory. Many experiments in this connection were carried out. During about one-third of the year there was either complete absence or excess of wind, and the force available was very variable. It was nevertheless found possible to save fuel for steam or gas-driven power producers. The cost per KW.-hour from peat-gas fired plant is approximately the same as from a windmill-driven installation. Attempts were made to design special three-phase generators capable of maintaining constant voltage independent of the speed of the mill, special attention being also paid to automatic adjustment of the sails in order to reduce the cost of attendance. A mechanical contrivance effects a turning movement of the sails so that during very high winds these occupy a position parallel to the direction of the wind, thus avoiding damage to the mill. Attention has also been paid to gearing and bearings to minimise losses in transmission from the sails to the dynamo.—*Manchester Weekly Times.*